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Moonbeams

Tales from the High Frontier

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Lightening

By Charles Lee Lesher

On January 2, 1959, Luna 1 launched into a direct-ascent lunar trajectory from the Baikonur Cosmodrome, atop a Vostok rocket. The spacecraft's mission was to crash into the moon but missed by 6000 km due to a control system failure. Instead, Luna 1 became the first manmade object to exceed Earth's escape velocity at nearly 8,900 kph. On January 3, 1959, it disappeared into the vastness of space.

June 2024: Lagrange One Station

Patrick Ryan Dugan gulps his beer then sits the bulb on the magnetic strip fastened to the tabletop. The crew calls the cafeteria the Fishbowl, not because the great round portal at the far end of the module looks anything like a tank, but because floating weightless behind it makes them feel as if they are the fish. Regardless, the place is packed.

Patrick is taking advantage of one of the better seats, gazing intently at the enormous crescent dominating the view. He never grows tired of the ever changing shades of browns and blues crowned with dazzling white, or the night side speckled with the lights of cities. It is much larger than any moon he can remember looking up at from Earth.

Earth…

Hard to believe it has been almost two years since he last felt its gravity or gazed at the sky from its surface. Patrick's first stint in space was aboard Lagrange One while it was still in LEO, installing the hardware for the Remote Mining Operations (RMO) that would eventually provide Longbow mass driver with ammunition.

He later accompanied the station to its final destination, the Earth/Moon Lagrange point L1. Now, four years later, he is on his third tour. His next assignment should be on Luna itself, unless Colonel Massey succeeds in blocking it.

"I would ask what you're thinking but undoubtedly, tiz work. Give it a rest, Patrick," Inga implores.

Patrick pushes aside thoughts of Massey, looking around at Inga,

Jonas, Kipper, and Kim. They have gathered to share the rare alignment of the space station's largest view port with Earth. He has supervised these youngsters since their arrival aboard Lagrange One and is justifiably proud of their accomplishments.

Together, they had the RMO running smoothly, delivering an average of fifty ore packets a day to Lagrange's solar furnace. These four people supervise an army of semiautonomous surface ROVs providing Longbow with over a hundred thousand pounds of lunar ore daily, material rich in iron, magnesium, aluminum, silicon, hydrogen, and oxygen. Yet, they are under pressure to increase throughput a whopping 60% by years end, and 150% beyond that. Earth needs more energy, which means more powersats, which means he and his team should be down on the surface personally supervising the mining operation from up close, not wasting time explaining what needs doin' to a bunch of military types. Sometimes talking with the Americans is like talking to a wall. He tries again to shove these thoughts aside.

"Aye, maybe you're right lass, but someone need keep it in mind," Patrick rumbles in his deep Irish brogue.

"Not all the time, Patrick. I know what you need, a bimbo arching for it!" Kim grins. "How long's it been?"

But before he can scold her, something bumps the headrest on his chair from behind, hard. He turns, ready to give some free advice to the perpetrator.

"Oh dear, I'm so sorry," the beautiful young woman says. Her long blond hair is tied back in a ponytail, making her look much younger than her twenty-five. Lively green eyes dart from one to another, lingering on Patrick.

Kipper reaches out and steadies her.

Thank you," the young woman says.

"Not a problem." Kipper responds, captivated by her clear green eyes and ready smile, keeping hold longer than necessary.

"May I join you?" the woman asks.

"Of course, Dr. O'Neil," Inga says.

"Take a seat before I break his neck!" Kim glares at her husband.

"What?" Kipper exclaims, spreading his hands, palms up, the very essence of innocence.

Inga grins while Jonas looks annoyed. The flirting may just be for fun but it's getting old. The four had met at the University of Southampton long before Kipper and Kim married. Neither would do anything to jeopardize their relationship with the other. Petty jealousy is simply a game they like to play.

"Dr. O'Neil, sit beside me," Kim says wickedly patting the seat next to hers. Two can play at this game.

"Thank you kindly. Please, you must all stop calling me Dr. O'Neil. My name is Abby." She settles into the chair, buckling its restraining belt about her waist, looking like a child taking a seat at the adults table.

"We know who you are. You're replacing Doc James," Inga says. Several weeks before, a seal had

failed in the medical lab resulting in explosive decompression of the infirmary. It was Lagrange One's fourth death and the first since arriving at L1. The other three had been during spacewalks while the station was still in LEO and under construction.

A shadow passes over Abby, "I'm not trying to replace him, just do my job." Glancing around the faces at the table, she continues, "Forgive me, but I don't remember your names."

"I'm Kimberly and this is my husband, Howard, everyone calls him Kipper." Pointing as she goes, "Inga Anderson and Jonas Odegaard, and I believe you know the Director." Kim says mischievously. She had seen the look that flashed over Patrick's face when he first glanced up at Abby and naturally interpreted it as sexual attraction. Who can blame him? Abby is gorgeous!

"Yes, Dr. Dugan and I have met, several times actually, in the few days I've been aboard."

"Greetings, Dr. O'Neil." Thinking back to their most recent encounter in the node outside the Western Space Command's main module, Patrick raises his eyebrows and asks, "So tell me lass, what's inside the WSC that Massey doesn't want me to know 'bout? Aliens? Death rays? The Pope?"

Abby grins, "If I told you, I'd have to kill you." When Patrick remains unsatisfied she adds, "Colonel Massey wanted to show me some of his toys. I believe he was trying to impress me. That's all."

"Did it work?" Kim asks.

Abby looks at her, shrugs, and boldly changes the subject, "You all have such pleasant accents. Where are you from?"

"Kipper and I are from England. Inga is from Sweden and Jonas is Norwegian." Kim turns to Patrick, "Where did you say you're from again?"

"Ireland," Patrick responds, wondering what Abby did not want to say about the WSC. Too much secrecy if you ask him. Then she turned those magnificent green eyes his way and everything else receded into insignificance.

"Ireland?" Abby asks.

Patrick pauses, basking in her gaze. Kim squeezes Kipper's arm and glares, silently warning him to keep quiet. Finally, Patrick says, "Aye, my father's Irish and mother's Sudanese. I was born in Kilmacanoge, Ireland, just south of Dublin."

Abby is fascinated by Patrick's resonate brogue. She's never met a black Irishman before.

"Mother grew up in Ireland but was originally from Wadi Halfa, Sudan, a border town south of Egypt on the Nile River not far from Lake Nasser."

"Fascinating," Abby says leaning forward with interest.

Patrick responds by leaning towards her. "Tell me about yourself, lass. Where's your accent hail from?"

"Not much to tell. I was born in Kansas and went to school in Massachusetts."

"You're being modest Abby," Kim says. "I understand you've two PhDs. Is that right?"

"Biological Science and Chemical Engineering. My specialty is genetic medicine," Abby replies. "Oh, I almost

forgot. There's a new excursion list and I believe you're all on it. Seems Col. Massey had to change his mind on some things."

"Good! Bloody nice to win one, now and again!" Kim exclaims, smiling at her husband's long face, knowing exactly what he was thinking, no more zero G sex. She'll miss it too.

"We're scheduled to go down day after tomorrow. They're pushing because of all the breakdowns. Seems the ROVs need some TLC." Abby says grinning.

"You're on the list?" Patrick asks intently.

They all laugh except for Abby. "Of course. I'm the Director of Medicine."

"But you're a geneticist. What're you doing on the initial occupation team?" Kim asks.

"Genetic medicine will be very important in keeping all of you healthy and fit but don't worry, I'm a fully qualified doctor. I can set broken bones and prescribe aspirin," Abby smiles and Patrick leans over even further.

The sound of warning claxons blares. The cafeteria erupts into motion and the great portal's protective shutters begin to close.

"What's happening?" Abby asks looking around nervously. With shocking suddenness, the view of Earth is gone. It is the first time she has seen the shutters closed and for some reason, it makes her feel claustrophobic. "It isn't noon," she mutters.

"Because Lagrange point L1 is meta-stable, like a frictionless ball sitting on top of a hill, every little nudge starts the space station moving away from the summit. Therefore, every few hours, Lagrange One undergoes station keeping, using magnetoplasma thrusters to nudge it back on top of the hill. This is much more extreme than normal station keeping."

"Attention, all personal report to the nearest shelter immediately." The message repeats over and over on the station's loudspeakers.

"Get buckled." Patrick reaches over Abby's shoulder and pulls the four point harness over her head, making sure she adjusts it to her chest size after clicking it shut. Within seconds, all the loose items are stowed and everyone is strapped in.

"Director Dugan, report immediately to Station Control," the voice of Captain Simms briefly interrupts the message.

With his thoughts in turmoil, Patrick unbuckles then glances at Abby. "Where do you think you're goin?"

"With you," she replies.

"You'll be safe here. The fishbowl is a shelter," Patrick may as well have been talking to the wall.

"As senior medical officer aboard this vessel, I have a responsibility to know what's going on." She doesn't hesitate after freeing herself from the restraints, agilely pushing off towards the exit with all the grace of an experienced spacer.

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Like a huge circular window, the main display dominates the far end of Station Control. Captain Simms floats motionless before it with Colonel Massey at his side. Twelve bridge crewmen are strapped into workstations

along the fifteen meter length of the module. Their tense voices murmur in the background as they communicate with a host of Earthside personnel.

Patrick pushes off for the Captain, taking perverse pleasure at Colonel Massey's expression when he turns and notices Abby at his side. The two men had tolerated each other before Abigail O'Neil had come aboard, but subtle dislike was quickly escalating into something more primal.

Captain John Marsh, commander of the ISS, occupies a small part of the main screen. Next to him is Admiral Robert Bortz, son of Admiral Mike Bortz, the chief of navel operations who killed himself nearly thirty years earlier rather than endure an investigation into his sex life. The Bortz family can lay claim to being a part of American naval history all the way back to Davy Jones. Now, it is a Bortz in charge of Mission Control in Houston, Texas. Lagrange One is ultimately his responsibility.

"I agree, get everyone into spacesuits, now," Captain Marsh says as Patrick and Abby come within earshot.

Captain Simms turns away to delegate the task to one of his bridge officers.

"John," Patrick nods to Captain Marsh.

"Patrick, it's good to see you again. I just wish it were under different circumstances," Admiral Bortz says. The old man keeps his silver hair trimmed short in navy fashion. His aged face is lined with wisdom and deep wrinkles surround his mouth like the ejecta from a lunar crater. But any who underestimate his mind, are in for a rude awakening.

"Top of the world to you, Admiral," Patrick responds. The fact the Old Man himself is concerned with the situation immediately sets off warning bells.

"Fifteen minutes to impact," *the computer voice echoes eerily along the length of Station Control.*

"Captain Simms, bring Director Dugan up to speed," the Admiral orders.

With only a cursory glance at Abby, a calm but intense Captain Simms cuts straight to the heart of the matter, "Twenty-two minutes ago we picked up what appears to be a chunk of old hardware coming out of the sun on a collision course with Lagrange One. Due to the object's small size and complete lack of emissions, we didn't pick it up right away. It is now less than fifteen minutes out."

"Fifteen minutes?" Patrick blurts out. Things seldom happen this fast when you're dealing with the vastness of space.

"This is the view from the station's one meter," Captain Simms directs the video feed from the telescope to the main screen, reducing the images of the Captain and Admiral to a small area along the edge.

Patrick floats over, hooks his toes under a strap and stares at the tumbling form. The object is backlit by the sun and thus, difficult to see any detail through the heavy filters protecting the telescope. "The object's definitely manmade. And old." He spends a few moments

pausing and magnifying the image at critical points, trying to determine its origin. It's a scorched and discolored metallic sphere roughly a meter in diameter. All markings have long since burned away. The few bumps and protrusions that mar its otherwise smooth surface testify to at least one close encounter with the sun. Yet, something in its shape tugs at his mind.

"We think its Luna 1," Captain Marsh says.

"Size fits," Patrick nods.

Looking around the module, Patrick locates Lieutenant Isaac Crenshaw, the station's Senior Science Officer, and floats over to him.

"This doesn't make sense, Izzy. Ya sure it's gonna hit Lagrange?" Patrick asks.

The lieutenant shrugs and shows him graphically the projected trajectory on his workstation screen. "God's honest truth, PR, everybody's above 98%. Ya'll'd have better odds bettin' on snow in July." Izzy is from Texas and speaks with a distinctive Southern drawl. "We checked, Houston checked, even your guys in Paris checked. Ya'll agree. This thing's a comin' right at us ten times faster than a speedin' bullet."

"What doesn't make sense, Dugan?" Colonel Massey asks.

Patrick swings around, "The physics of the gravity field surrounding Lagrange make it highly unlikely that something would actually collide with us. T'would be like a hurler whacking a ball at the base of Mount Everest and scoring a goal at its summit. The teeniest pebble would send the ball reeling off in a new direction."

Hurling is the great Irish national sport. Traditional hurling pits one village against another. The players, each armed with a wooden club, would attempt to hit a leather ball through a goal in the opposing village. The game was played over ditches, across fields, atop hills and through forests. Since opposing hurlers would be attempting to move the ball in the opposite direction, it was common for hurley sticks to be used for more than just batting the ball.

The modern game is much more civilized, played with a length of ash flattened at one end, on a standard grass playing pitch. Two teams of 15 players each attempt to pass and hit the ball over or through a crossbar at opposite ends of the field. The game is one of the world's fastest sports and Patrick was quite good at it in his youth.

"Then I'm right. This must be an attack!" Colonel Massey utters emphatically.

"Why should that be, Colonel?" Patrick asks.

"Three very good reasons, it's manmade, it's headed straight for us, and you just confirmed it couldn't be an accident," Massey responds, fear inching up his spine. He did not need to say who would have the audacity to launch such an attack or who would have the most to gain if Lagrange One were damaged or destroyed. Tensions with China were at an all time high and his implications were clear.

"Actually, I didn't say it couldn't be an accident. I said it's unlikely," Patrick says looking back at the graphic.

“It’s coming in too fast for any spacecraft to match orbits with it and the nearest shuttle is a day away so we can’t evacuate,” Captain Simms says.

“The missile doesn’t exist that can catch it before it hits you,” Admiral Bortz adds. “Besides, blasting it would only increase the odds of a piece hitting the station.”

“Then our choices are few but exceedingly clear. We either deflect it or get out of its way.” Captain Simms says calmly.

“Then let’s move!” There’s a hint of panic in Colonel Massey’s voice.

“Lagrange One’s not a spacecraft. Without the Orbital Transfer Vehicle to provide some real thrust, we simply don’t have the power to do anything but stay put,” Patrick says wondering briefly how this man obtained his space rating. “With only station keeping thrusters at our disposal, t’would be better doing nothin’.”

“Why?” Captain Simms likes the sound of that, latching on to this glimmer of hope.

Captain Darrel Simms is a career Navy officer with aspirations. He had gone after Lagrange One because only an assignment of this magnitude put that dream into high gear. Over the last decade, commanding a ship on the world’s oceans has become a second tier assignment. The road to the Admiralty now goes through space.

“Because the gravity field around Lagrange One will increasingly affect the object’s path as it draws near. Given the limited distance we can move the station, we’re better staying put and hope it skittles off as it climbs the hill.” Patrick answers, thinking furiously.

Stung by the cold dismissal of his idea, Colonel Massey says, “We cannot shoot it and we cannot move out of its way. If all you offer is hope, then we should all get on our knees and pray to God Almighty for deliverance!”

“Quiet! Let me think!” Patrick says irritably, having returned to stare at the image of the object.

Colonel Massey’s nostrils flare in anger. “How dare you…”

“Silence!” Captain Simms interrupts. Petty squabbling is something he has very little tolerance for at any time.

Patrick triggers his cell phone embedded in his right ear, “Kipper? He pauses until the young man responds. “What’s the current status on all collection ships?” He listens to the answer. “Good! Don’t have time to explain but I’ll be commandeering OSC14.”

Patrick agilely twists about to face Captain Simms. “We’ve a full ore collection ship within range of the object’s flight path. I suggest we put it in the path of the object.”

“What good would that do? It would only make matters worse. Instead of one object coming at us, we’d have a thousand,” Massey says.

“Not necessarily,” Lieutenant Crenshaw says. “It could deflect it just enough to miss us.”

“How much mass is aboard the ore collector?” Admiral Bortz asks.

“Tiz nearly full, Admiral. Twenty-seven megagrams, maybe a pinch more,” Patrick responds.

“English,” the admiral asks

someone off camera.

"Sixty-thousand pounds," a distant voice replies.

Turning back, "That just might do the trick," Admiral Bortz says.

Captain Simms looks at the Admiral who nods. "Lieutenant Crenshaw, establish a secure comm link with the ore ship. Lieutenant Sato, begin calculating the orbital dynamics to move it into the path of the object. Ensign Parker and Harris will assist."

Patrick floats over to Lieutenant Crenshaw, "Izzy, the ships coordinates are dec 32.1 lat 254.8. Use security code PRD010348 on frequency 832.01201"

The lieutenant inputs the numbers and waits for the station's main communications dish to skew about. No one speaks. The only sound is the murmur of commands as the bridge crew scrambles to calculate the trajectory.

Patrick wipes sweat from his face using the back of his sleeve. He is not the only one feeling the pressure, Massey looks ready for a straight jacket and Abby is forcing herself to remain calm. Only Captain Simms seems to be taking this in stride. Abby shoots Patrick a strained smile, a much needed vote of confidence. He hopes he's worthy.

"Communications established," Lieutenant Crenshaw finally says.

"Maximum burn will put OSC14 in intercept position in T-minus nine point nine minutes. Fuel reserves will be down to less than one percent." Lieutenant Sato doesn't sound like he's convinced this will work.

"That's all right, lieutenant. Make it so," Captain Simms says wiping dampness from his upper lip.

"Yes sir," Station Control falls silent as the command set goes out. Time drags as they wait.

"Ten minutes to impact"

"Transmission received and maneuver has begun," Ensign Harris' voice shatters the silence.

"Captain, may I suggest we rotate the station to put the solar furnace 'tween us and yon object?" Patrick offers.

"That'll put the solar panels edgewise," Lieutenant Crenshaw adds.

"We can't afford to lose that power. Our batteries have not fully recharged from the eclipse," Colonel Massey is handicapped by an inability to see the station in his mind's eye. He doesn't understand the advantage of presenting the smallest face towards the object. All he knows is that the backup system is not at 100%, not even close.

"The batteries are the least of our worries. Besides, they should last an hour," Captain Simms says after glancing at the power indicator at the bottom of the main screen.

Patrick snaps his fingers, a sharp clear sound within the module. "We can energize the furnace! The containment field will deflect smaller particles."

Colonel Massey glances at Patrick then back at the Captain, "Not if the furnace is draining them. Lucky if they last more than a few minutes."

“Ensign Parker, rotate the station but hold off on energizing the furnace,” Captain Simms orders. “Lieutenant, keep the telescope on the object but put up a graphic to track the progress of the ore ship.”

The object’s image shrunk then slid to one side. The rest of the big screen transformed into a three dimensional representation of the station, object, ore ship, and moon. The various trajectories are displayed in living color showing when and where they will meet. All eyes are on the bright blue dot representing the ore ship as it moves into position.

“Ensign Harris, are station personnel ready?” Captain Simms asks.

“A moment, sir.” The young man flips a few switches and murmurs into his mic.

“Eight minutes to impact”

Captain Simms rubs his nose waiting for the answer. He learned long ago to be patient with his crew. The tougher the situation, the calmer he became.

“Sir, many are still getting into their suits. Sergeant Estevez estimates another ten minutes,” Ensign Harris reports.

“Tell Sergeant Estevez that he has five,” Captain Simms says. “Patrick, Abby, you need to get into your suits as well.”

“With all due respect Captain, by the time we did, t’would be all over. I’d like to stay here, if it’s right with you?” Patrick says.

“Very well.”

Everyone aboard now notices the station moving around them. Those free floating suddenly find themselves rubbing up against a wall or each other. During normal operations, Lagrange One rotates slowly like a precision timepiece, completing a single cycle once every 27.3 days. It happens so slowly that most people cannot even tell it’s taking place. It is this intricate dance, worthy of the finest Swiss watchmaker, which keeps the solar panels and solar furnace always pointed at the Sun even as Lagrange One orbits the Earth, which in turn, orbits the Sun.

“Six minutes to impact”

“Five minutes to intercept,” Lieutenant Crenshaw says.

“Captain, the station will not be in position. We are currently at max angular momentum. Any more and we risk shearing the central gearbox,” Ensign Parker has faith in Captain Simms but this is beyond anything she has been through.

“Maintain control, Ensign,” Captain Simms says.

Movement draws Patrick’s eyes to the small image of Admiral Bortz. The Admiral’s deep into an animated conversation, speaking to someone Patrick cannot see. Even without the audio, it’s obvious that something’s going on.

“Trajectory is resolving. If the ore ship doesn’t stop it, the object’ll hit AG3 close to the node,” Lieutenant Crenshaw drawls. AG3 is an agricultural module dedicated to growing soy and rice.

“Ensign, continue the rotation,” Captain Simms says calmly.

“Aye sir,” Ensign Parker

responds. She's struggling with the maneuver. Lagrange is just too massive to move quickly. She has not given up on getting the station to its assigned position. Only now, she is pacing the movement so that the furnace will be where it needs to be when the object arrives. If the rotation is too fast or too slow, she will leave the station vulnerable. The delicate timing worries her but it's the only way to do it.

"Four minutes to impact"

"Losing solar arrays, switching to batteries," Colonel Massey says. The huge solar farm is fragile and designed to move slowly.

"Captain, the array will not be completely edge on when the object arrives," Ensign Parker is sweating bullets. Never in her life did she dream of anything like this. A year ago she was attending the Air Force Academy in Colorado. Now, she is right in the middle of life and death on the high frontier.

Captain Simms floats over behind Ensign Parker. "Relax, Ensign. You're doing everything right."

The Captain's words are little comfort as the lights dim.

"Parker, what'n Sam Hill ya think you're doin'? You've done put the ag node right square in the bull's eye! Captain, if it hits that node, we'll lose half the station!" Lieutenant Crenshaw exclaims.

"I'm following orders! … sir," Ensign Parker is cracking under the pressure.

Captain Simms floats over to look over Lieutenant Crenshaw's shoulder, "The station is rotating. In another two minutes, the impact point will be on AG1."

"Who needs veggies?" Patrick asks lightly. AG1 contains over half of the vegetables grown aboard the space station.

"Two minutes to impact"

On the main screen, the ore ship slips into position and stops right in the path of the oncoming object, its fuel essentially gone.

Patrick looks at Izzy, "What say you, put OSC14 on screen?"

Lieutenant Crenshaw glances over his shoulder at Captain Simms, "Do it, lieutenant."

Instantly the graphic is replaced by the silvery outline of the ore ship, the sun glaring beyond it. At over fifteen meters in diameter, it is one of the largest vessels in space, but from here, it looks small and fragile.

"Thirty seconds," Lieutenant Crenshaw drawls wiping a bead of sweat from his brow.

Time stands still.

"The entire world is watching and praying for your success," Admiral Bortz injects into the silence.

"Yes, God be with you," Captain March adds.

"Contact in ten seconds," Lieutenant Crenshaw says. "nine, eight, seven, six, five, four, three, two, one, zero…"

"One minute to impact"

The object came and went so quickly that at first Patrick thought it missed. Then he noticed a meter wide opening in the side of the ore ship that wasn't there before. Dust

particles glisten in the sunlight shining through the hole.

"What in bloody hell just happened?" Patrick exclaims roughly.

"I'll be dipped! It blew right through!" Lieutenant Crenshaw exclaims.

"How can that be?" Patrick utters. The preprocessed regolith has mass but no stopping power.

Furiously recalculating the object's trajectory, Lieutenant Crenshaw's face turns pale. "Holy shit, Cap'n, it's comin' right at us! Central hub's the bull's eye now!" Central hub is not only the geometrical center of Lagrange One, it contains the essential workings of the station. Without it, the station cannot control its orientation in space, and thus, keep the solar array pointed at the sun. Without solar power, the batteries will eventually run down setting Lagrange One adrift and sliding off its gravity hill.

"Ensign Parker, will the furnace be in position?" Captain Simms asks, realizing even as he spoke how useless it will be as a shield.

She looks up at him with tears in her eyes, "Yes sir. But what good will it do?"

"Well, I guess that's it then," Captain Simms says softly. Hell of a way for his last command to end, way out here at the ass end of nowhere.

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"Damn it Captain, it's my responsibility! Now FIRE!" Admiral Bortz commands loudly.

All eyes in the control module turn towards the Admiral and the sudden explosion of sound.

"Put the object back on the main screen," Captain Simms orders, grasping at the slightest straw.

Precious seconds pass as Lieutenant Crenshaw finds the fast moving object and gets it on screen. At first nothing happens, then for what seems like forever, atomized metal particles vent from a small hole in the object. In reality, it lasts for less than a second, ending with an explosion that peels back the skin around the point of attack, releasing a tremendous burst of hot gas.

"Admiral, what's happenin'?" Patrick asks.

"Some kind of laser beam," Abby states. She's seen tumors behave the same way when using a laser scalpel on them.

"Quite right, Doctor O'Neil. It's called Dragon," Admiral Bortz says with sadness.

"Dragon? What's a Dragon?" Patrick eyes narrow as he watches the object disintegrate before his eyes.

"A Dragon is a diode-pumped, multi-stage, high-energy, titanium-sapphire, solid-state laser." Admiral Bortz explains. "It concentrates 50 gigawatts of power into an ultra-short, ultra-high-intensity pulse that repeats 150 times a second. So you see, Doctor, it's not really a beam but it is capable of vaporizing any material unfortunate enough to be in its path."

As they talk, the Dragon continues to pour energy into the defenseless artifact as it tumbles in space. After the initial great puff, the hapless sphere becomes the center of a growing cloud of hot gas and particles.

"Hey ya'll, it's still comin' right at us," Lieutenant Crenshaw reminds everyone.

"Yes, but now tiz small particles!" Patrick exclaims. "Time to impact," he demands.

"Twelve seconds," Lieutenant Crenshaw answers.

"Get that furnace on!" Patrick orders emphatically.

"What! Are you mad? We are on batteries!" Colonel Massey exclaims.

Patrick locks eyes with Captain Simms. "The field generated by the furnace will deflect the particles."

"Make it so, Lieutenant Crenshaw. Route all available power to the furnace."

Colonel Massey is in major meltdown, watching the lifeblood of his batteries pour into the furnace's electromagnetic coils.

Seconds later, the outside cameras pick up a flickering light that quickly intensifies forming an eerie halo around the station. At its height, the aurora completely surrounds Lagrange One, protecting it just like the Earth's magnetic field does during a solar storm. It is over in seconds.

"I'll be damned! Admiral, this Dragon of yours should be standard equipment aboard every space station," Captain Simms says.

"Aye and I'd like to have several at my side down on Luna," Patrick adds. Abby floats over and hooks her arm in his. They are puzzled by the aura of defeat that has descended upon Admiral Bortz.

"You can take that up with my replacement. I'm relieving myself from duty, effective immediately," Admiral Bortz says.

"What's wrong Admiral?" Abby asks.

Captain Simms nods slowly, "I think I understand. The Admiral has revealed something our superiors would have rather remained hidden."

Admiral Bortz tips his head ever so slightly and turns to Patrick, "Director Dugan, my last official order is to wish you good luck down on the surface. It will not be easy carving a life from such an inhospitable place." He looks at Abby, "If only I were younger…"

October 2024: Aldrin Station, Luna

In complete silence, the Dragon reaches out to touch the vertical face of the tunnel. Immediately, the contact point disappears behind a cloud of atomized particles which the laser relentlessly plows through to reach virgin rock.

The path of the beam glows ghostly within the swirling hot gases. As predicted, cloud generation reaches equilibrium with its dispersal into lunar vacuum. Like a red hot knife sliding through warm butter, the high energy beam burns a hole almost as big as his wrist and twenty feet deep in less than a minute.

Whoops of joy reverberate through Patrick's headset as he powers down. "Bloody marvelous, Patrick! Well done, man!" The voices of his team bombard him.

It's complete vindication, the final step in what has been an arduous journey. His only regret is that Admiral Bortz might never

know. The Admiral stopped answering his phone a few weeks after using the Dragon to save Lagrange One, but not before seeing to it that Patrick had his own.

He sighs, strangely depressed when he should have been happy. Before starting on the next hole, he crabs the Dragon sideways to a predetermined location. The device worked perfectly, punching a dozen holes into the rock face in a fraction of the time the old technology could drill just one. Slow to disperse, the atomized remains of the lunar stone forms a thin haze around the mobile drilling platform squatting in the newly excavated tunnel.

Before this, moon miners used mechanical drills to grind out the holes necessary to set the explosives, an effort that required several hours and the frequent replacement of cutting heads, each one manufactured and shipped from Earth to the moon at great expense.

Patrick sighs again, commanding the ROV to back away. For every step forward, someone must pay, sometimes with their life, sometimes with their career. Patrick looks forward to sharing a pint with Abby and the others. They'll raise a glass to one of humanities unsung hero's.

Epilog:

Lagrange point L1 is the perfect location for humanity's next major space station, the natural gateway to the moon. This one-of-a-kind point in space is located on the direct line between Earth and Luna about 200,000 miles from Earth, or conversely, a mere 39,000 miles above the geometric center of Luna's nearside.

Similar to the ISS, the first station at L1 will be a simple affair constructed of cylindrical modules whose size will depend upon the heavy lift capability of our biggest cargo launchers. However, it will not remain this way for long.

As we develop the moon's resources, this station will grow as humans and their robotic partners transform it into a bustling manufacturing hub. It may one day contain a host of materials processing plants supported by large scale lunar mining operations centered around Luna's first Mass Driver.

L1 is also the perfect location for the first practical Space Elevator down to the lunar surface. L1's foundries will forge the first geosynchronous Space Based Solar Power Satellite and other mega structures that will eventually occupy L4 and L5. Until something better comes along, L1 will serve as a fine jumping off point to the rest of the solar system.

We are not short on designs for these mega stations. A Bernel sphere will support 10 to 30 thousand colonists, the classic Stanford design is a torus capable of supporting 140 thousand, and Gerald O'Neil favored a huge cylinder supporting millions. I suspect the final shape at L1 will be a compromise between a sphere and a torus thereby taking advantage of the meta-stable nature of the point to eliminate station keeping.

Energy will be the cash cow that initially drives its economy

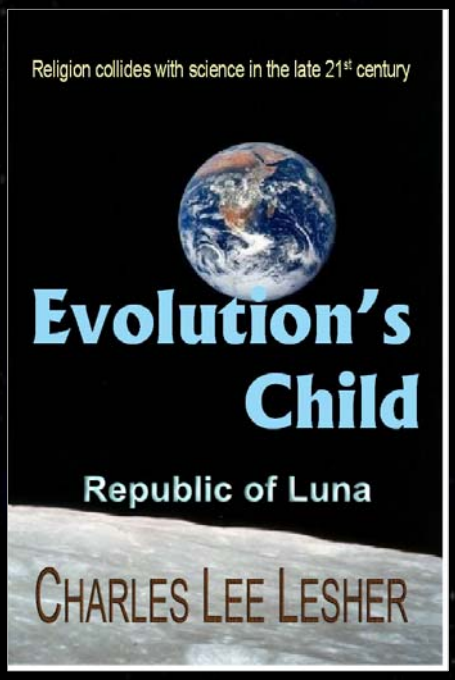
and tourism, both real and virtual, will also play a role, but it will be the spirit of adventure that draws our young people to brave the vast inhospitable frontier of space.

One thing is certain, Lagrange point L1 is unique, and if America does not move quickly, other nations will. After that, we can only hope to rent a room on their space station. Take your pick, owner, renter, or outsider looking through the knothole. Pardon me, but I much prefer owner.

Charles (Chuck) Lesher is a founding member of the Moon Society Phoenix Chapter, serving as Vice President. He has a BS degree in Engineering Mechanics - Aerospace, and an MS degree in Material Science.

He wrote a piece on his design for a space station at L1 which appeared in MMM #216, June 2008, page 3. Chuck has a hobby of making large scale models which he hopes to upgrade into a profit making business.

His novel about lunar colonies in 2092, "**Evolution's Child**," appeared in April 2007 (Writers Cramp Publishing, 328 pages, ISBN-10: 097772350X) The second novel in the series is due out late first quarter 2009.



Chuck was appointed Editor of Moonbeams in October 2008. He lives in Chandler, Arizona.

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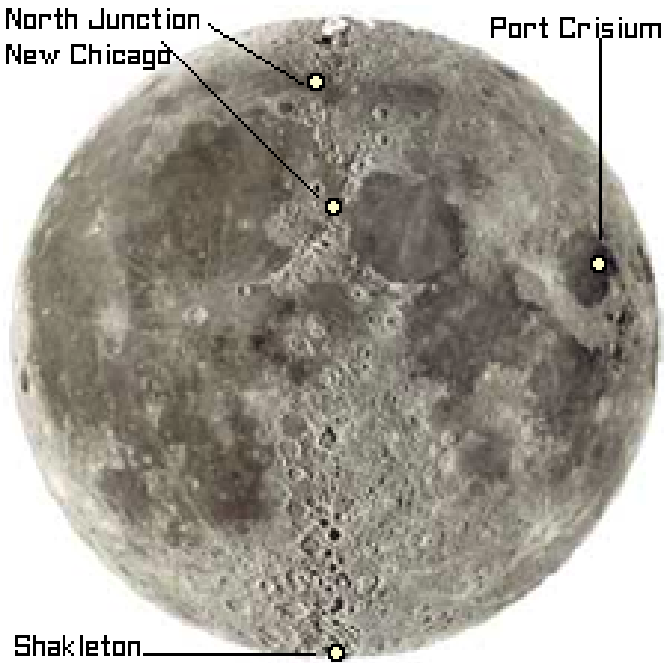
The Cheshire Smile from Andromeda

By Pierre Jean Trudell

Alternating teams of the Lunar Spelunking Society had been exploring one layer of lava tubes below another for almost two years when they finally reached the lowest level. Ground penetrating radar so far showing no more voids as they slowly explored this last winding tube. The C team apparently would be the last, as radar indicated this "De Profundis" tube (Latin for "out of the depths") would dead end around the next bend.

Of course, lava tubes don't just end! They drain out onto an earlier surface as the active lava flow slowly comes to a halt. Then again, the radar might just be picking up a substantial collapse with an unreachable continuation further down the line of flow. But that didn't matter to Beth Jenkins, head of the team. They had sensed the end of two years of sub surface exploration was near, and had asked for an extension so that they could be the team to close this venture.

The team was both excited about the prospects of returning to Port Crisium along the eastern "shore" of this frozen lava sea,



at the inlet of Mare Anguis, The old Artemis Society's "Angus Bay," and a bit let down that all that they had discovered was more of the same.

Lunar lava tubes vary much less than do their much smaller terrestrial counterparts. And

tubing on the Moon was very routine in comparison with exploring limestone caves on Earth which come in such great variety. But then caves created by flowing and dripping water are something quite different than those formed by flowing streams of hot molten runny lava!

It was Taygeta evening going into a long weekend. In the lunar calendar, two months of 59 days together were divided into 8 weeks, with three of those having 3 day weekends. Of course, we worked five days every week. There was just an added 8th day, three weeks out of eight. This was a favorite perk of telling time by lunar rhythms rather than Earthly ones.

C Team had just had their camp style dinner, after pitching the pressurizable "Moon Hogan." Three crew members had asked to have their meals put up as they wanted to take a peek around this last and final bend. Grudgingly, Beth had agreed. The tour was about over, and she was ready to relax discipline a bit.

"Oh my God! Oh my God! Oh my God!"

The voice was unmistakable. John Cook's southern Ohio drawl was recognized anywhere. But the tone of his voice was not. Excitement, awe, bewilderment, confusion, a potpourri of emotions uncharacteristic of this quiet laid back professor of exospeleology was evident to everyone as they stopped what they were doing and paid close attention to the radio.

"Someone has been here before us, and I don't think it was anyone from Earth!" Wow, now the suspense and bewilderment rippled through the rest of the team.

"It's getting late," interrupted Beth. "Take some pictures of what you see from where you are standing, go no further, and come back to camp.

We'll all explore together whatever you've seen, tomorrow morning after we break camp, and have had a good night's sleep."

It goes without saying, that no one slept too much that night, especially after Cook and his two companions showed their photos!

"Question after question, but no answers!"

Scarcely rested herself, after a quick breakfast which everyone gulped down, Beth led her team, twelve in all, around "the last bend." They had left their camp in occupancy mode, because, of course, they expected to be staying their for an unknown duration. She had not reported back to the surface base camp as yet, because there was nothing but uncertainties to report. Hopefully, they'd soon have answers.

As they rounded the bend, their RTG powered wide beam search lights soon revealed what last night's scouts had seen, a circle of hewn basalt marker stones, looking for all the universe like the 1x3x9 black markers we all had seen

in the 2001 and 2010 Clarke-Kubirick films. And, yes, that turned out to be the ratio between depth, width, and height. About 20 feet, or 65 meters tall. And yes, of course they were hewn from the basalt in the walls of the tube, evidence of quarrying easily seen.

Last night, the three eager scouts had got no further. The precision of the stone shapes, quite unlike those of Stonehenge, and their similarity to the monolith's of 2001: A Space Odyssey, were what convinced them these stones were not hewn by men of Earth. Besides, throughout their downward zigzag meandering from the surface base camp, there was no sign that anyone had been this way before. No tracks, nothing disturbed since the formation of each of the five layers of tube-ridden lava flows they had explored. Whoever had come this way before had come from another direction, and/or covered their tracks well, leaving no tracks, at least not any noticed so far.

What's that in the center?

Last night, Cook's group had ventured no further once they saw the near side of the monolith circle. Everyone was expecting some thing climactic to be in the center of the enclosure, an unknown focus still shrouded in mystery.

Beth, exercising her prerogative, led with the searchlight. As soon as they got close enough to the outer perimeter, even before examining the monoliths themselves, all eyes peered past the liths towards the center. The central plaza was not flat, but a hill, and from the perimeter, one could not quite glimpse what was on top of the mound.

Excitement, anticipation, and fear were all immixed, creating an atmosphere of runaway anticipation. Heart rates and pulses were up considerably. Even Beth sweated inside her suit as they made there way up the hill to what Cook was already calling the "altar."

What would they find a full two kilometers below the present surface of Mare Crisium, the "Sea of Crises?" Virtually everyone was guessing, some wildly, like Gus, who expected to find a scene of alien sacrifice. Later, he assured everyone that he was just kidding. He was as in the dark as everyone else. Indeed, whatever was on top of the mound, if anything, had been there in the absolute darkness of the lava tube interior, for God knows how long. Thousands, hundreds of thousands, millions, billions of years?

Finally as they neared an apparently flat area at the top, they saw something that looked very complex in shape.

Then Cook shouted, “it’s a model of a galaxy! Ours? Some other one?”

Unlit since it was built, under the search light the untold myriads of stars began to blaze, some brightly, some two faint to be seen without magnification. But all of these swarms of mini-suns seemed to just float there in the space above the mound. It would be a while before Jeff Moroni realized that each and every one was suspended by a nanofiber from a platform that blended in all so well to the topography of the tube ceiling vault.

The next couple of hours, they took precise measurements, and photos galore, carefully documenting what vantage point an angle they were taken from, so that a model of this “exhibit” could be recreated on the surface when they got back.

That night, after supper, the speculation was wild. The detail of this miniature galaxy was mind blowing! The model must include a million stars or more. Does it depict our own galaxy as seen from another far away? Was it a view of another galaxy which none of them had recognized? How long ago was this exhibit put here?

By whom? And most intriguingly, why?

Finally, the lack of sleep from the night before and all the excitement of the day got the better of them, and almost everyone slept.

In the morning, some reported wild dreams of far away star systems and stellar empires and strange but beautiful alien big brothers.

Two months later

Astronomers already on the Moon were soon joined by many more from Earth as a fair size encampment was built in the tube near that last bend. The University of Luna Port Crisium campus, it was dubbed. Little did these experts suspect how much larger this makeshift research institution was about to get.

Soon there was a very accurate computer model of this mystery galaxy. Then computer programs began to compare what they had from various perspectives to nearby galaxies, for each of which, we of course only had the view of how they looked from Earth, from our own galaxy.

It took a few weeks of supercomputer time before the answer emerged - a confident answer. The galaxy so painstakingly modeled was indeed our own, and the perspective from which it was

originally modeled was also clear, from the Great Andromeda Galaxy, Messier 31.

But that was not all. From the relative position's of the Milky Way's family of dwarf Satellite galaxies, in comparison to their present position, this model had to be designed about 250 million years ago, ± 20 million years – a quarter of a billion years ago!

To put that in perspective, our Sun and Solar System had made one full orbit around the galactic center in that time frame. And as not all stars have the same "galactic year" or share the same vector of movement, stellar neighborhoods are always changing. It is likely that only a small fraction of our neighbor stars at the time this fantastic exhibit was installed are anywhere nearby currently. In contrast, the galactic neighborhood shifts much more slowly!

How was this conclusion reached? The clues were the arrangement and details of the satellite dwarf galaxies and of the largest halo globular clusters. Put the known motions of these stellar congregations in reverse and about 250 million years ago, ±20 million years, our galaxy must have looked like this. There could be no mistake. As much as all spiral galaxies may look alike to some, they each have distinctive features. And this was clearly our galaxy, the Milky Way. Of course, to viewers inside spiral galaxies, all galaxies must look like "milky pathways" encircling the heavens in a full circle, a meandering through the star fields of any planet's nighttime sky.

But the positions were off in a clear pattern. From the vantage point from which the data was gathered, the edge of our galaxy nearer the imaging point, compared with the edge furthest from the that vantage point, detail positions were advanced or retarded according to the number of light years apart, between nearest and furthest edges, roughly a hundred thousand light years.

Careful study of this "slant" compared to data we have on our own galaxy, showed that the imaging point was close to edge on, about 15° south of the galactic equatorial plane, and from the direction of Andromeda, pretty close to where the great Andromeda Galaxy, Messier 31, would have been. With the Milky Way open at 15° (half the maximum openness of Saturn's rings as seen from Earth, their view could not have been as breathtaking as our view is of their own Andromeda Galaxy, at a greater angle, that better exposes to us M31's awesome structure of arms, star clouds, and central nucleus.

Confidence in this conclusion grew to certainty as it became clear that the details in the model were not uniformly resolved. Areas of our galaxy facing the direction

of Andromeda were clearly richer in fine detail than those on the side away from Andromeda. But these people, the imagers, must have spared no effort to gather as much detail as they could from their perspective.

But, but, but!

Solving three mysteries, “what?”, “from where?,” and “when?”, left the biggest questions still unsolved. Did people from M31 travel 3 million light years to install this magnificent exhibit in a lava tube 3.8 billion years old that was likely to remain intact for how ever many hundred million years it might take for intelligent life to emerge on this planet?

Even advanced fusion propulsion experts unanimously turned thumbs down on this idea. Traveling to nearby star systems in our own galaxy was dubious enough. To go 3 million light years, rather than just 30 or so, was too much of a stretch for the most confident minds to make.

Soon enough, the “dual messenger” theory began to emerge. The “Andromedans,” whoever they were or whatever they looked like, used their advanced astronomical abilities to create this model of the Milky Way and then had broadcast it across the light years, in our direction, with a beam wide enough to cover all reaches of our galaxy, and probably had done so for millennia, if not for thousands of millennia, so that any contemporary civilizations in our galaxy could have received this transmission.

But, also apparently, they had not wanted, or needed, to tell us about themselves except to let us know that they existed and wanted to give us this gift. A “Cheshire Smile” if you will.

They were the first messengers, giving us a superlative view and perspective of our own galaxy, that we who live within it could never have acquired for ourselves, no matter how long our civilization thrived, or how advanced it might become. Messengers cannot travel at the speed of light, but messages can and do!

Then some intelligent race within our own galaxy, who happened to be within the vicinity of our solar system at the time, figuring that we were ripe for the emergence of life, sent a tended or drone probe this way. It must have been crewed, however, to be able to find the lowest level of a multi-layered tube complex, and then deploy the exhibit within this monolith circle.

Clearly, the initial gift from Andromeda has been “regifted” within our galaxy, by at least one then thriving stellar civilization, within whose reach, our solar system had wondered at the time. The chain of lucky circumstances was almost as mind boggling as the message itself. But it is also likely that these Regifters created a similar

exhibit wherever else they found a planet on a pathway to a climax stage where intelligent stewards would take over and guide further development. Indeed, having themselves received the exhibit plans by radio transmission might well have been the trigger that brought them to become a star faring people. Driven by the deep need to share, to regift.

Indeed, the Andromedans might have created similar exhibits of other nearby galaxies and broadcast the plans in those directions as well. One can only wonder how many civilizations within our local galactic supercluster may have been on the receiving end, directly or indirectly!

Soon, everyone wanted to try to figure out whatever could be learned about the Regifters but alas, we still don't have the start of a clue. After 250 million years, their home sun may have wandered half a galaxy sway from our own sun. It seems most unlikely that we will ever find out anything more about them, except this one thing. Taking a clue from the Andromedans, they too, had left us a "Cheshire smile!"

Three years later

And that was where things stood for almost three years, until another crew visited the site to look for anything that had escaped notice by the first few. On the last scheduled day of this "Beta Expedition," this "cleanup" crew found a narrow entrance to yet another chamber. The entrance had been hidden behind an outcrop, shaded from the searchlights of the previous expeditions.

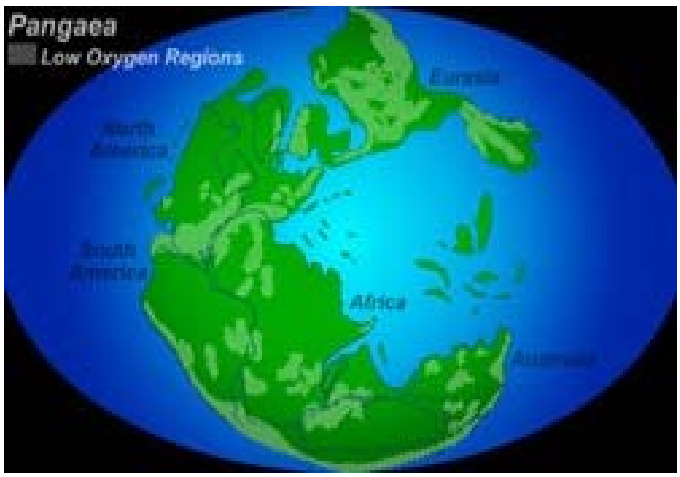
"It's an Earthlike planet!"

"No, it is Earth"

Once the Beta Expedition crew emerged from the narrow passageway into the chamber beyond, their searchlights revealed a giant 53 meter blue, green, brown, white globe that looked amazingly Earthlike. The continents seemed all wrong, however. Photos were taken and transmitted to waiting experts on Earth and elsewhere on the Moon.

The answer came quickly. The model Earth-like planet looked very much like the reconstruction of the arrangement of our continental plates in the last "Pangaea" period, with a global ocean encircling the huddled chain of land masses. And sure enough, we get the same date by this argument as that from the miniature Milky Way galaxy model – c. 250 million year ago!

Geologists soon confirmed that the continental pattern



was close to what they had envisioned about 250 million years ago. Only the detail of mountains, coastlines, desert, and artic areas was beyond any paleogeologist's wildest dream.

Will wonders never cease?

Again more surprises lay waiting in a much larger chamber beyond another narrow passage.

As if we had not had enough surprises, this one humbled everyone. In this chamber was an exhibit of the flora and fauna of every continent at that time long ago. Detailed models of how creatures and plants looked, along with detailed models of their skeletal structures, for those who had them, and internal organs. There were exhibits of evolutionary trees. Other exhibits showed specific dioramas, charts of temperatures and climate swings. It was endless.

These Regifters not only left us the gift from the Andromedans, which they seemed to have spread to one potential intelligent species fertile world after another, but they also left us a record of what our world was like when they came our way.

And once again, "they" left us no record of themselves, neither of their cultures nor of their technological achievements. Well, at least from these two breathtaking instances, the argument that Star Trek's famous "Prime Directive" could be something most if not all post adolescent intelligent species would follow began now to gain new respect. Sure there are individuals and even societies which are selfish squashers of anyone they find to be inferior; but such attitudes may tend to disappear as cultures emerge from the kind of adolescence our planet now suffers from.

In both cases, the Messengers and Regifters wanted to give us a message about ourselves, not of themselves. (a) A view of our galaxy and of our world, not now, not from an Earth-centric perspective, (b) but from perspectives we could never hope to enjoy.

Will these discoveries change us?

What a gift! What gifts! We did not exist when the Messengers and the Regifters separately, but in sequence, each decided to begin a "cathedral building" task that must have taken many years, with no expectation of ever seeing the results. What faith this shows that despite all the evils we see in our own civilization, that the destiny of intelligent civilization will overcome these growing pains – wherever intelligent races arise!

These gifts bring enormous knowledge, not of "them" but of ourselves, our home world, our galaxy. We'll never know anything more about either Messenger civilizations, except that we must now aspire to mature in the direction they

did.

All we will ever see of these species, is their “Cheshire Smile.” It is evident, that how a species is designed, how it looks, how they reproduce, what their material culture and civilization is like, is immaterial. It’s the potential that we have inside that matters. And these two messenger examples give us confidence that we’ll find a way to get past our present cultural crises.

Since this double discovery, we hear less popular talk about “alien” and “possibly hostile” species. Instead, we hear more expectation that physical and cultural distinctions aside, we are all more deeply formed by our shared conditions of existence. It is now in vogue to talk about a certain real virtual spiritual and mystical brotherhood that pervades all space and time. Even without a single concrete detail, few now ask “are we alone.”

We need no further proof to know that we are anything but alone. Intelligence is potentially everywhere. We have become so at ease with this “Cheshire brotherhood”, that one can go outside, look up at the stars, and say “hi there,” knowing that all over the universe their must be countless others looking up into their own heavens and saying hello in return, collectively giving homage to the creative forces that have brought us all into being and into virtual contact.

We no longer have our sights trained on the various destinations within our solar system Now that we have the model of our galaxy, we are beginning to feel the call to share it, to become a space faring species on our own, in order to do so. That is something we must do in time, to fully become what is in us to become, spreading not dogmas but our own, “Cheshire Smiles.”

The speed of light ceases to become a barrier. It becomes the means. What more could we wish for but to become Messengers ourselves, and spread our own Cheshire Smile wherever we can, for the benefit of intelligent species yet to arise?

Nubium Pool - Perseid Calls

By Frederick Hills

Moon Base Gamma

Mare Nubium (Sea of Clouds)

August 11th, 7:30 AM CST

Jeff Miller stood by the door of the newest module at the base. He had worked on this project for years. As an Olympic swimmer he had long thought that someone should build a pool on the Moon. After all, people need more than a plain old exercise room for keeping fit or providing diversion from the normal work routine. There is a more important consideration too: when tourists start coming to the Moon they will want the whole lunar experience - everything that makes the environment here different from Earth.

Humans retain their normal strength on the Moon. But here the force of gravity is only one sixth that of Earth and one can jump far higher. Perhaps one could leap out of the water as dolphins do on Earth. Jumping into the water would produce a splash covering an area far larger than on Earth.

NASA began listening once the factory on the Moon began producing metals from lunar regolith (the pulverized rock that is the Moon's surface). These metals could be used for new construction without the cost of transporting it from Earth. The thing that finally did the trick was an offer from FarOut Adventures to pay for that material. They were now busy lining up well healed adventurers for such excursions.

Jeff had been on the Moon now for almost a year leading the construction effort in addition to his 'job' as engineer in charge of electrical power for the base.

"Good morning"

Jeff turned. It was Chuck Smith the man in charge of the diesel generators that provided power through the lunar night.

The generators run on bio-diesel fuel. During day bacteria in large vats multiplied in the sunlight. Some of it was drawn off and processed into fuel, which was put in storage tanks until nighttime. Then the diesel generator running on the fuel and oxygen produced electricity as well as exhaust gasses carbon dioxide and water. These were then stored until the next day when they would be consumed by the bacteria and completing the perpetual cycle.

"Oh hi", Jeff replied. "You are just in time for the big event." He spun the valve open to transfer water from the reservoir into the pool. Gurgling sounds were heard and water soon started flowing in.

"Can I take a dip this

morning?”

“No, the pool won’t be full until tomorrow. I’m going to breakfast.”

They both turned and headed for the dining hall in the adjacent module.

Jeff got scrambled eggs, hash browns and orange juice. He walked across the hall and set his tray down on a table across from Neha. Then without saying a word walked over to the clock on the wall. The longest hand indicated the current phase of the Moon. The days were numbered 1 to 29. There were also cute symbols for the four primary phases. The new Moon symbol was at the top. He reached up and advanced the hand to day 13 and returned to the table.

Neha was born in Virginia to Indian immigrants and raised there. She earned a degree in computer science from Virginia Tech. She worked for several years with a defense contractor in Maryland and then accepted a job with NASA. She was fascinated with space and jumped at the chance to work on the Moon.

“Good morning Jeff,” said Neha. I notice you do that now and then. The time is right. Why isn’t the day right?”

“That clock is a simple mechanical, battery operated model. It keeps good time but the lunar cycle is not exactly 29.5 days long. The correct day is displayed next to time on our computer displays, but that clock falls behind by a few hours every month. When it looks too far behind I adjust it.”

“I see. The Moon symbols don’t seem appropriate though. When we look at the sky it is the Earth we see, not the Moon. In fact I enjoy watching the Earth going through its phases.”

“On that I agree completely,” said Chuck, who was now seated at the table too.

Their breakfast was soon interrupted by the sound of the klaxon and an announcement. “Attention! Moon Base Gamma is now in condition Zebra. Please check any doors near you and close them if they are not closed at this time. That includes all other fittings in your area marked Zebra. Whenever you open a door be sure to close it behind you.”

“Reminds me of my days in the U.S. Navy.” Said Chuck as he arose to close the door to module 1. The only difference was that the navy was concerned about keeping water out of its ships, while the lunar base was concerned about keeping air in.

“I knew this was coming,” said Jeff. “The Perseid meteor shower is in progress.” He went to close the door to the pool and took a peek. There was a growing puddle at the far end of the pool, but clearly a long way to go still.

Upon returning to the table Jeff added; “If you have time to look out the window you can see flashes produced by tiny meteorites striking the surface. I saw a few during

the Eta Aquarid shower in May."

"What would a one kilogram meteorite do?" asked Neha.

"That would produce a flash that can be seen on Earth with a small telescope. I understand that 200 to 300 objects of that size strike the Moon every month."

"How big a crater would that make?"

"I don't know off hand, but there is a web site that can calculate the approximate results for an object of specified size and approach path hitting the Earth or the Moon. I do know that a one kilogram object would get burned up in the atmosphere before it hit the Earth. But since the Moon has no atmosphere…bam!" Jeff punched his right hand with his fist for emphasis.

"Oh my!" she exclaimed.

"Time for me to get to work. I need to install a few light fixtures today."

August 12th 6:00 AM CST

Jeff awoke, rolled out of his bunk and dropped to the floor. (He had the top bunk in the cabin.) Each cabin had its own small bathroom and he proceeded to shower. After breakfast he decided pool was full and shut off the flow of water.

Next he tackled the normal routine, checking the status of base electrical systems and orders for the day. Top of the list was replacing the power inverter in the bus that would be needed to receive the arriving passenger shuttle from Earth that was scheduled to arrive in four days.

The task was fairly easy. He grabbed new unit and lugged it out to the service bay where the bus was parked. The bus was linked to the air lock so he could easily walk aboard. He lifted the floor panel over the inverters and unbolted the cables. After replacing the old unit, he ran the test program. The test was successful. So within an hour everything was cleaned up and he went on to the next task.

August 12th 4:28 PM CST

Neha was working at a computer in module #1.

This was the original module and was divided into sections by curtains. (Solid partitions would have added too much weight to the package.) One section served as the base entry. There was the original ground level door with a dozen space suits hanging along the wall nearby. Toward the back were two more doors, one for the transport garage/service area and the second for the generator room. The fourth was the access to module #2 and the dining room. All four 'doors' were actually air locks consisting of two doors separated by a space large enough for two people. These were essential for going outside of course. Between modules they would allow people in and out even if one of the modules lost air pressure.

It was time to load system

updates to the servers. She was required to be at the machine being loaded as a security precaution and so that problems elsewhere on the network would not interfere. She inserted the last of three memory sticks and waited for the load to finish.

The sound of the air lock opening reached her ears. “How is it going, Neha?” It was Chuck.

“Fine, what’s up?”

“Just going to check on the diesel generators and transfer the load to #2.”

As she watched the load timer count down toward zero, she heard the door to the generator room close.

Without warning, there was a loud sound of ripping metal and a thud. She felt air leaving the room and bolted for the air lock to module #2 as the lights went out. She felt weak as she reached for the door handle, thrust herself in and tried to close the door. The cable that she had in her hand was not quite clear of the door and prevented it from closing completely.

Feeling dizzy she slumped to the floor.

****

Under emergency lights Jeff examined the situation display on his computer. It indicated that air pressure in module #1 was rapidly approaching zero and that both generators had shut down. He activated the priority lighting in all the modules except #1 and simultaneously called the generator room.

Chuck answered immediately: “Yes, the generators have shutdown. I can’t start either of them because whatever hit us must have ruptured the heat radiators on the roof. There is no water in the system.” (These radiators serve the same purpose as the radiator on an automobile, cooling the engine. But instead of transferring the heat to air, it is radiated into space as infrared light.)

“Do you realize how close that was?”

“Yes, I’m still shaking.”

The director rushed up to Jeff and asked, “What is our status?”

“We are using battery power to provide power to essential services. The generators are not available.”

“Can we restart them?”

“No, it appears we have been struck by a meteorite which broke the radiators for the diesel generators and punched a hole in module #1. The air in there is gone.”

“Alright, now we need to account for everyone. Call up the personnel location display.” (A diagram of the rooms in the base with location markers for personnel.)

“Yes, sir.”

The display showed the location of each personal cell phone and icons turned green as each individual acknowledged.

“Oh God no,” said Jeff. “Neha is in module #1 and has not acknowledged.”

He immediately got up and headed for the airlock to

module #1 with the director right behind him. The lights over door indicated that there was no pressure (i.e. no air) in the room beyond it, but there was pressure within it. There was only one ray of hope Jeff thought as he opened the door.

The door opened easily and yes there she was. Sitting on the floor leaning awkwardly against the wall and apparently unconscious. Jeff lifted her out and laid her on the floor as the director called the base doctor.

Within minutes, the three of them had Neha on a cart, into the medical center and hooked up to monitoring equipment. Jeff pulled up the pressure record for the airlock, which the doctor now studied. The graph showed that the air lock pressure dropped at precisely 4:31:28 PM when Neha opened the door.

"The pressure got pretty low then followed the programmed restoration path after the door closed." After a thoughtful pause, the doctor continued, "She may suffer some from Hypoxia or decompression sickness."

Jeff recalled the training sessions on decompression they all received before coming to the Moon. There were lots of possible outcomes including death.

Neha opened her eyes, and turned her head.

"How are you feeling?" The doctor asked.

"Cold", she replied.

The doctor placed a blanket over her.

"Why did you have that cable in your hand? " asked Jeff.

"I was fiddling with it while waiting for software to load. I think it stuck in the air lock door."

"You must have pulled it out when you fell. Look, there are scrape marks on it near your hand."

An announcement came over the address system: "Will the facilities team please report to the director's office."

Jeff promptly headed that way.

****

The director and the rest of the team except Chuck were all there as Jeff walked in.

The director queried each member beginning with the Air Handling system and on to power.

"What is our power status, Jeff", the director asked?

"We are using the battery bank which supplied power through the lunar night before we installed the diesel generators. Although the base is a lot bigger now, the system can meet our needs well past sunrise when we start using solar power."

"I want to get the generators running as soon as possible so that I can assure NASA that we will be ready for the new crew. They want that assurance before launching the team tomorrow. What are our options?"

Chuck replied over the intercom, "We need to restore

the flow of cooling water to the diesel engines. I see two options: Fix the radiators on the roof or find another source of cooling water."

"What is the status of the radiators?"

Jeff stepped in, "All we know is that the cooling water was lost to space. It would not be prudent to send someone to the roof during a meteor shower. However, we could send one of our robots up to get video images for evaluating the damage. An alternative is to use water from the pool. I think there is enough pipe to reach the generator room. The heat will be dissipated via the pool."

"What do you think of that, Chuck?"

"Let's pursue both."

The director sensed that all agreed and said: "Go do it."

As the meeting broke up, Jeff assigned his assistant to inventory the pipe and then he set down at the nearest computer to request assistance. A robotic grader was available and 'operator 26' available to drive it. The operators were in Utah and he opened the communications link.

"This is Jane, how can I help?"

"I need to get pictures of our facility. How long would it take to move grader 3 to the top of module #1?"

"About 30 minutes."

"Please move it to the base of the ramp to the roof and contact me, I will leave this line open."

Jeff went and grabbed a sandwich from the kitchen.

He sat at the terminal to eat his lunch. Occasionally Jane spoke as if giving progress reports to herself and eventually announced; "I have the ramp in sight."

"Good. The ramp surface is loose fill so proceed with caution. Our goal is a pair of radiators on the roof, which are, located a short distance to the left. We believe a meteorite hit them and went through the roof. So look out for debris."

"Sounds messy. I'll proceed with caution. Are you monitoring the video?"

"Yes."

"Oh! Is that a new crater?"

"Certainly looks like it. We will have to study that one day. Move about six feet forward and do a pan."

"Ok."

"Stop right there, the radiators have been sliced into pieces . . . by flying debris I assume. What do you think, Chuck?"

"It would take too long to bring them in and rebuild them."

"Jane, you can leave the unit there. Thanks for the help."

"You're welcome. Bye."

Jeff went to the pool service room and found his assistant. "Do we have enough pipe?"

"No. Not even enough pipe to get from here to there. We need another 14 feet to get there."

Jeff thought about that for a minute. "Wait, we don't need the pipe coming from the reservoir now. Let's cut out what we need from that. So we will lay pipe from here to the generator room through the service tunnel, and let the return flow run along the tunnel floor."

"That should work. We will have to spread the end of each pipe section to make connection to the next pipe section."

"Ok, let's get started."

The two of them setup an anvil and supports for the pipe sections so that one person could do the work. Then they took turns hammering on one end of each to expand them and checking that the untouched ends would fit inside.

This continued through the night. Then they slid the sections into the tunnel. There wasn't much room in the tunnel and it was cold down there. The assistant climbed in and opened the doors all the way to the generator room. Jeff handed him one pipe at a time and helped force them snugly together. Jeff had already installed a submersible pump in the tunnel by the pool.

Finally the setup was complete.

Jeff called Chuck. "We are ready. Start the diesel and see if we can get the water circulating."

After a minute Chuck confirmed water was flowing through.

Jeff watched the water rise at his end and confirmed that the pump started after it became covered by water. By the time the water flowed through the tunnel, the pool, and back to the diesel engine, it was reasonably cool.

August 13th 8 AM CST

Jeff and his assistant had been watching their handiwork run for some time now, too tired to move. Then the Jeff's cell rang and he lifted the device to his ear.

"This is Rick. I took some food to Chuck last night and noticed the hole left by the meteorite was fairly clean. So with the director's approval I got a helper and we patched it. The ceiling is as good a new and pressure has been restored."

"Golly. That is good news. I will restore power there."

"By the way, our resident astronomer is in there already gathering up the pieces of the meteorite."

August 16th 8 AM CST

The sun had been up for 3 days now, and everyone at base was excited about the impending arrival of the new group. The command channel was on the public address system so they could follow progress.

"We have acquired the beacon at Lunar Base Gamma."

Minutes later: "Now we see the markers at the landing site."

Above the swimming pool and behind the 10 meter dive platform was a small

observation deck where Jeff and a few others were trying to spot the arriving spacecraft. The sun was now in the same part of the sky where the spacecraft should be, which made the search tricky. "I see it," said Chuck.

Jeff soon spotted it below, left of the sun and followed it to touchdown at the marked landing site 200 hundred meters northeast of the base.

Soon, the new arrivals, three women and five men, filed into the dining room where the director was ready to greet them. Introductions all around took place. Then they were shown their quarters and allowed to settle in.

The director invited them to meet him at the pool after lunch for a relaxing swim.

After being cooped up in the shuttle for six days a swim sounded wonderful.

August 16th 3:30 PM CST

The director, in his swimsuit, arrived at the pool to greet the guests again. "I see you folks are still getting used to walking where gravity is only one sixth of Earth's. Now you can sample the joys of swimming on the Moon. The water is fairly warm today… mostly because it was cooling our generators until a few days ago. Jeff, the pool director and silver medal winner at the Olympic games in Mexico City, is up on the ten meter platform to demonstrate proper form."

Jeff stepped off and rolled forward. It looked as if he was in slow motion. The weak gravity here took its time pulling him down. He wrapped his arms around his knees and like a cannon ball hit the water. Gushers shot up and majestically spread until everyone in the room was wet.

He jumped out of the pool and addressed the group.

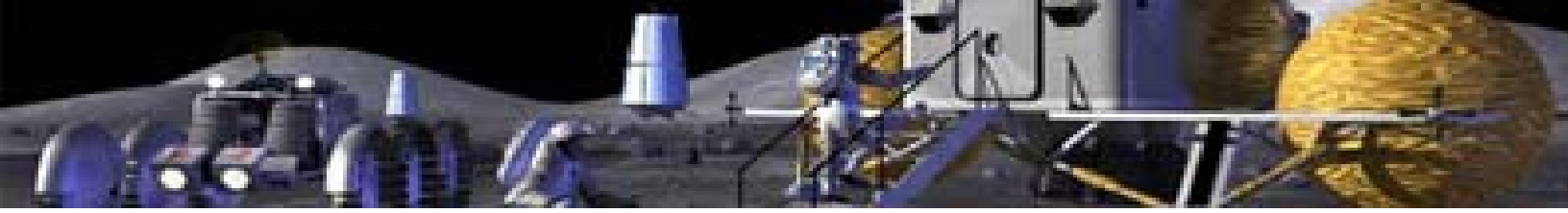
"Welcome. You are free to use any of the four diving boards. Those that want to swim should use this end of the pool. No running please, especially on the diving boards."

The group had a great time in the pool and contemplating what the next two years here would bring.

Fred Hills was elected to the Moon Society's Board of Directors on August 1, 2008

Why Central Standard Time?

- that is the time at the command center in Houston, Texas
- since most members of the moon team have family in the USA, it is convenient
- since the lunar day has no relation to human sleep cycles, why not



Letters Home

Moonbeams invites you to contribute a micro story. See the Submissions page for details.

Dear Diary…
   5/20/28 Today I blew the main transmitter. I didn't mean to – it just happened. No one was hurt but it was close. I couldn't live with myself if some one had been killed. I have a whole new appreciation for Captain Jacobs. I wouldn't want his job for anything!

Secure Email…
2/3 Shift Report, Oct 30, 2028
Space Mining Inc, Nubium Base
To: Shift Commander Jensen
   Craig - First shift started in on Section 221 but were called off when Casey found a rich lode of ilmenite in Section 901. They committed a shovel and a transport but by the time I arrived for second shift, they had both shovels and all three transports working it. It looks good, very good. Mission Control has authorized you to pull another shovel from Adams over on Section 140 and two more transports. This is the richest TiFe deposit we have ever found. MC wants us to put this in high gear.
   Also, we had some problems with the ROV links. Lost about two hours while the geeks got it up again. They say they don't know what happened which makes me nervous. Let me know if you have any problems.
   DH

Dear mom and dad…

Scientific Observation…

Personal story…

Hate Video Phones…

ROV and robotic exploration…

Miners Daily Log…

Come up with your own…

An Email Home from the Moon

By Richard Steffens

Dear kids,

Well, here we are! We're in our room at the Luna City Hotel, after a wonder filled, full day. The rest of the flight was pretty much as I described in my last email, sent from our ship, the Melva Gay. It was thrilling to watch the Earth disappear as we went around the Moon in preparation for landing. We had watched the Earth get smaller each day, and then it was like watching the sun go down!

The landing was smooth as can be. We hardly felt a bump! The flight attendant asked us to remain in our seats until the spacecraft came to a full and complete stop, and the disembarkation tube had been attached. It's funny. I thought it would be an unusual looking contraption, but it's not much different from the ones at the airport, just taller. That's because we tend to bounce when we walk up here, and we need the extra ceiling height! Your father wasn't paying attention at first, and nearly put a dent in the roof! I told him, "Bob, you've got to watch your step. Just because you can, doesn't mean you have to act like a spring chicken." Well, it didn't take too long to get used to it. It was a bit strange at first. I'm glad we took that trampoline class at the gym before the trip. It was good practice for bouncing!

Anyway, we went down the walkway into an area that wasn't very different from the boarding area at the airport. There was a shuttle bus docked at an airlock, just waiting for us. It looked like a big tube with rounded ends, sitting up on enormous tires, only the tires were hollow, just like the ones on the old Apollo Moon rovers. I noticed out the window that there were a couple of flatbed trucks over on the other side of our space ship. They were similar to the shuttle bus, except instead of looking like a tube, they looked like spheres with a flat trailer bed behind them. We could see the drivers operating small cranes, loading containers from the ship onto their truck beds. I think that's how they get the luggage over to the hotel.

It didn't take any time at all to get on the bus, and then we were rolling over to the entrance portal to the elevator that takes us to Luna City. There was another air lock, and another airport like waiting area. Luna City is built on the floor of a lava tube. Dick, our tour director, explained that the lava tube is a kind of gum drop shaped cave about a half of a mile wide and

a quarter of a mile tall, with the roof being about forty feet thick. He said that there were all sorts of benefits to be had by building inside the cave, but I think I'll let your father tell you about that later.

The elevators are made with big windows. They give a marvelous view of Luna City. We could see the city laid out before us, and we could see the sides of the cave, too. What impressed me was the comparison of these lava tube caves to the ones we visited in Hawaii. The shape is similar, but the scale is quite different. As our tour director told us, they'd have to take the antenna off the top, but the Empire State Building would fit inside this cave! Your father just can't wait to go on the behind the scenes tour and see how this place works. I think I might go along, too!

On the bus ride over, Dick, handed out the key cards for our rooms. They work like credit cards at the gift shop, too. He also gave us brochures with a map of the hotel and of Luna City. It looks like it will be pretty easy to find our way around, but having the map is comforting. I wouldn't want to get lost on the Moon, and you know how your father is about asking directions!

The elevator deposited us in a central plaza, and after a short walk through a delightful park, we entered the lobby of the Luna City Hotel. Just like everywhere here, the ceilings are taller, but other than that, it's pretty much like any of the nice hotels we've stayed in. Actually, there is one thing that's a little different. There are more plants here than you'd find in a typical hotel. Something to do with keeping the air clean. They must know what they're doing because the air here is as fresh as at a mountain resort.

Well, we decided to go right to our room and check it out before going exploring. I really like what they've done with the hallways. Remember I told you about plants being everywhere? On the walls of the hallways, they have murals made with plants. It's kind of like the floats in the Rose parade, only instead of being glued on petals, these are live plants, growing on the wall. They give off a nice fragrance, too.

Our room is quite comfortable. It has a huge canopy bed, with wisteria growing on top! How heavenly. There's a balcony with a view of the gardens in the atrium of the hotel. The bathroom is complete with a shower and a spa/tub, although I don't know when we'll find time to relax in that. Your father teased me about it, though. He said, "Jean, now don't you go spending the whole afternoon in a bubble bath. We've got places to go, things to do." He knows I haven't used bubble bath in years, but he does like to tease! That's ok. I just

remind him about the yellow duck soap on a rope incident and it quiets him right down.

There are lots of plants in our room, too. One wall is completely covered in English Ivy. I've noticed gardeners working on the rooms right along with the maids! They say it's all for the oxygen. So, I guess that's a good thing.

After seeing our room and dropping our carryon bags we decided to have a look around the hotel. Just in case we'd need it, I picked up the brochure with the map on it from the credenza where your father had left it. ;-)

We had taken the elevator up to our floor, but we decided to try the stairs on the way down, just so we'd know where to find them. Imagine my surprise when, instead of stairs, we found ramps! As I think about it, I haven't seen a stairway since we got here. Since we are on the fifth floor, there were five flights of ramps to hop down. They have big arrows on the floor, showing us which ramp is for up and which is for down. You get to going pretty fast, and it would be quite a jolt to run into someone, so it just makes sense to have one way ramps.

There's another interesting feature of the ramps; they have banked curves. If you can imagine a typical multi storied stairwell, with the stairs switching back and forth, that's the way these ramps are built. You go half way down to the next floor in one direction, and then switch back to the other direction for the second half. Instead of a flat landing at the halfway point, they have banked curves. Your father said it reminded him of the indoor track in the balcony around the basketball court at his high school.

The surface of the ramp is different, too. Do you remember the time we went up to Mt. St. Helens and stopped at the visitor center about half way up, the one run by the highway department and one of the lumber companies? Do you remember the playground that you ran over to before I could stop you? I watched you trip and fall on what looked like hard blacktop, but you jumped right back up as if nothing had ever happened. I remember when I got over to that playground, how amazed I was to find that this stuff that looked like blacktop from a distance was actually kind of bouncy, like the bottoms of your sneakers. Well, they use a similar stuff for the floors of these ramps. I suppose they are taking pity on us newcomers — they have new folks up here every week, so I guess it's just good planning.

Before we knew it, we were back at the lobby level and headed out into the garden. We could see this garden from our balcony, but it was amazing that even though we knew how big it was from up there, we couldn't tell that from inside it. You can look up a path and see it curve away, and you never see the end. The plants

are beautiful. It's a tropical paradise with more varieties than I can begin to name. And birds, too! What lovely songs they sing. There's a little brook that winds through the garden. The path crosses it many times with little bridges. Every so often, there's a short little stub of a path leading into a little area with either a bench, or a few chairs. The garden was obviously designed for relaxation.

Somewhere near the middle of the garden is a fountain with a dedication plaque attached to it. It explains how Luna City grew out of the dreams of a group of space pioneers calling themselves Artemis Society International, and that the city is the outcome of The Artemis Project. There are bas relief sculptures of several of the founders of the organization and a brief history. And sitting on a pedestal is a computer running an Internet web browser. You can use it to look at anything on the net, but if you leave it unattended, it always returns to http://www.asi.org, the home page of the Artemis Project. They tell us we'll hear more about the Artemis Society and the project on the behind the scenes tour, tomorrow.

We strolled around the garden for a while, every so often encountering some of the other folks we met on the flight out. Then it was time to go to the welcome dinner in the hotel's banquet room. All the folks on the tour were there. After a nice meal, our tour director introduced the hotel staff and then spent about 10 minutes telling us about the things we'd be doing for the rest of the trip.

Tomorrow we have the behind the scenes tour and the rest of the day to explore Luna City. Then the next day we start a six day excursion to visit two of the Apollo landing sites. I was a bit concerned about people trampling all over the historic footprints, but they told me that we will be inside looking at the sites through big windows. That made me feel better. It would be a real shame if someone were to add their footprints to the historic ones. But then, you know me and historic preservation. We can have a photo of ourselves emailed from the site with certification encoded in it to prove we were there. I'll tell you more about that when we get to the little hotel they have there. Since it's a good distance away from here, we'll have another bus ride. They showed us pictures of the "motor coach" as they called it. It's a lot bigger looking than any bus I've ever been on. It reminds me of a Pullman car from the railroads, but longer and taller. The one in the picture even had a name on the side, just like the railroad cars do. It was called the Neil Armstrong. I'll let your father describe that to you, after we've seen it first hand.

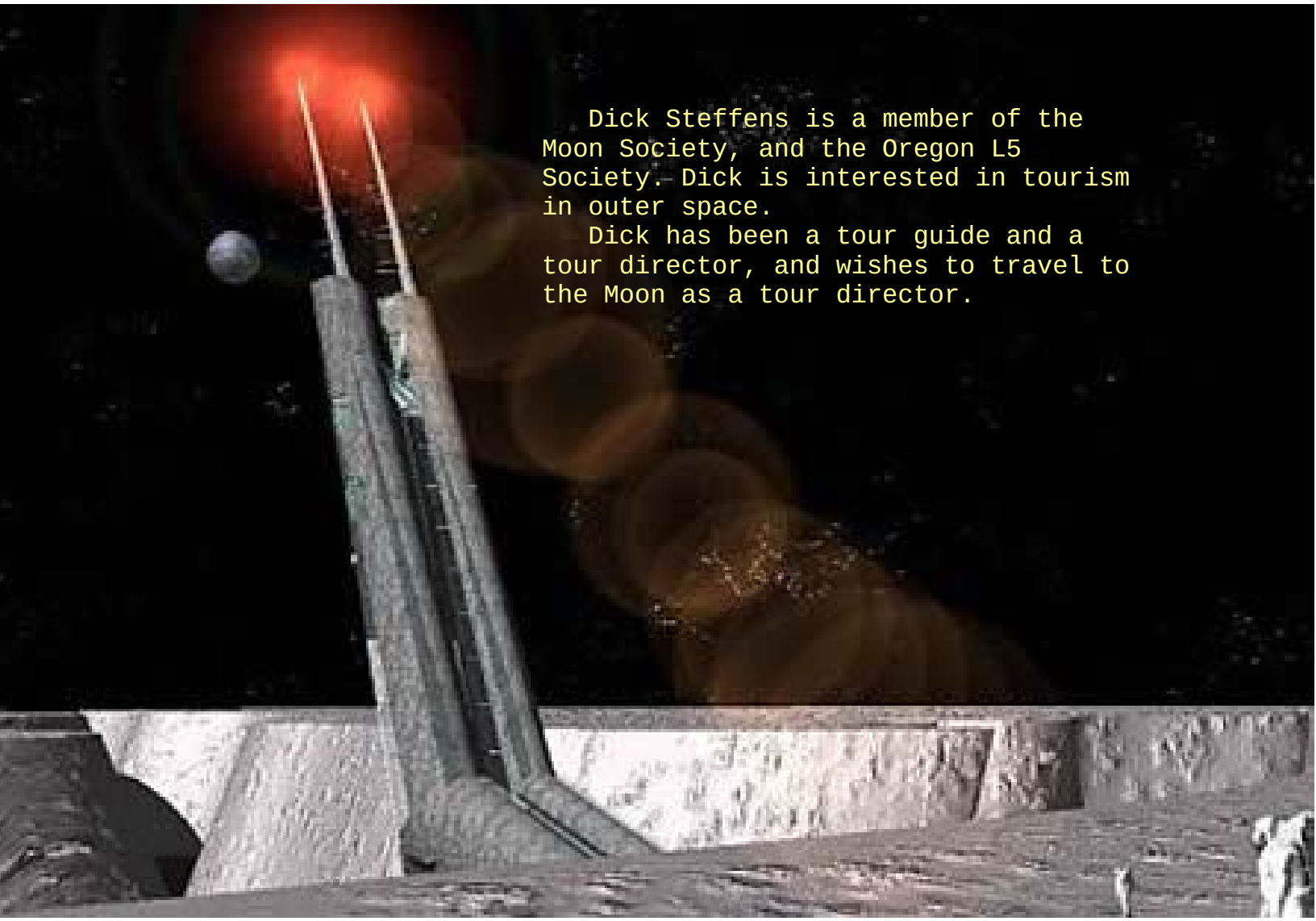
After the welcome talk from

Dick, our tour director, there was a drum roll and fanfare while the hotel staff folded back a wall revealing a dance floor and an orchestra! We spent the rest of the evening dancing in one-sixth gravity. What an enchanted evening! We waltzed, we danced to swing era music, we danced to rock music. We lost track of the time! Eventually we could tell that the orchestra was getting a little sleepy, so we thanked them for a wonderful evening and let them go home to bed. Then we realized that we were getting sleepy and came on back to the room.

So, while your father's in the shower, I decided to sit down and write you this email. We'll send you another one tomorrow night. We're having a wonderful time. I know you'll enjoy it when you come, too.

Good night.

Love, Mom. XOXO



Dick Steffens is a member of the Moon Society, and the Oregon L5 Society. Dick is interested in tourism in outer space.

Dick has been a tour guide and a tour director, and wishes to travel to the Moon as a tour director.

Ceramic City

By Peter Kokh

Dear Mom and Dad,

How goes it down there amongst the green hills of Earth? Things are really picking up for me here up grayside.

Today (it's sunrise here on what we optimistically call the "Garden Coast" of Mare Crisium) I began work for Geltaftan-Luna, the settler-owned construction company that is building Port Tanstaafl. At sunrise the company yards came to life as actual construction work depends on concentrated solar energy. During the preceding fourteen days of darkness, workers put together the forms and molds we will use, sifted lunar soil, overhauled machinery, and did other non energy intensive work in preparation for the nest two weeks of busy city building now upon us.

At dawn, the great mold-wheels of assorted diameters and depths were filled with the first of their carefully measured portions of sifted lunar soil. (That's my job - a bit humble, but it's a start!) Then the great solar furnaces come to life concentrating the fire of untamed sunshine and directing it through a heliostat onto the soil charge in the bottom of the mold-wheels. As the charge melts (mare soil, being basaltic, has a very low viscosity and flows freely) and the mold-wheel begins to spin, the born again magma flow easily over the reinforcing fiberglass mattes (made of nearby highland soil with a 360° F higher melting point) and around the carefully designed and precisely placed plugs that will be openings for doorways, indirect skylights (to be fitted with sun following heliostats) and even for periscope picture windows. These openings owe an inspirational debt to the wind catchers built into ancient Iranian adobe buildings.

The mold-wheels are precision shaped to have a parabolic catenary curve and the resulting fiberglass reinforced cast basalt domes will have maximum strength in compression (from the soil overburden in case of habitat decompression) and tension (from excess air pressure within, not quite wholly compensated by the weight of the soil backfilled above.) The domes have a reinforced inner lip to securely anchor the floors which are fused in place once the domes are erected.

After the domes and floors have cooled down, the interiors are given a "sodium glaze" closely related to the salt glazing commonly practiced on Earth. The glaze is applied under high heat with first pressurization so that it is

really forced into every last pore to make the structure quite airtight. Moldings for hanging pictures or some of those pretty fiberglass tapestries are already built in - you don't dare try to make a nail hole! Some settlers put a sort of lime whitewash over the glaze. Others like the slightly browned (from the sodium) gray tones as they are.

Just as lathe workers learned long ago to produce more than simple turnings, Geltaftan-Luna has some very sophisticated mold wheels that turn out tunnel and conduit sections, vaults and apses, and other more complex structural elements of the modular city. We also make elements that are not turned such as paving slabs, watertight plant beds for the farms, shade walls for waste heat radiators, etc. And we fuse soil outside all the entrances and airlocks to minimize troublesome soil hitchhiking a rid inside on wheels and boots. While the swiftly multiplying Geltaftan Cooperatives on Earth use basically low tech methods, here on the Moon, it is all appropriately high tech or at least precision work. It has to be so, as our environment is mercilessly unforgiving.

The great mold-wheels, are, of course, mobile, advancing with the edge of city construction. But some units are built to move rather quickly, for use outside the city. Next sunth, I get to go out into the field. We will begin constructing a new terminal complex for the spaceport, some thirty miles away, out farther on the mare. Fusing of the new reinforced landing pads was completed last sunth.

In case you wondered how the domes can fit together to make larger structures and the city as a whole, suffice it to say that they best lend themselves to groupings based on a hexagonal grid or honeycomb. Of course this pattern is broken by streets (pressurized, naturally) and cuniculars (pressurized pedestrian walkways or alleys.) Actually, this method of building has a whole consistent language of expression so to speak, and you'd be amazed at the variety of designs Geltaftan-Luna architects have come up with to make the city anything but predictable and boring! Yes, magmatecture, as we call it, is transforming our little corner of the Moon, all from on site materials, with the result that the city looks homegrown (it is!), as if it truly belongs here, almost as a native life form.

By the way, I am studying Lunar Architecture, LunArch 101, to be exact, as a part time student at U of L. It is really a fascinating and exciting new field, and I feel my future here is wide open.

My Marimba lessons are going well. Did you know that the ceramic tubes used in the Marimbas are made by Geltaftan employees in their spare time? This kind of experimental art and craft enterprise is

encouraged by the management, and they will even get you whatever tools you need.

Well, Mom and Dad, its been nice chatting but I've got to get to work.

I'll write again soon,

Love, Graham

Peter Kokh is the President of the Moon Society and long time author and space colonization advocate.

Peter's Email address president@moonsociety.org

http://www.moonsociety.org/

http://www.lunar-reclamation.org/bio_pk.htm

HELP WANTED:

- Fiction Authors w/ Imaginative Short Stories
- Nonfiction Authors w/ Referenced Articles
- Creative Artists, Illustrators, and Cartoonists
- Willing and Able Assistant Editors

If you have something that you think we might be interested in, drop us an email. See details in Submissions.

My Flight on the A.F. Jules Verne

By Simon Cook

The sleek “silver sliver” of our Boeing 8O8B Columbiad gently eased off the rocket sled trolley that served as its 'first stage' at the end of its track at Jose Marescal Aerospaceport just north of Quito, Equador and began its streak for orbit. (At 9500 ft elevation and smack on the Equator, Quito had became the first civilian gateway to space, serving both the Americas Similarly advantaged, 8600 ft high Nairobi fills the same need for Europe, Africa, and western Asia The third gateway, serving East Asia and Australia is Singapore whose sea level handicap means smaller payloads and fewer passengers to orbit.

Within the hour the Columbiad pulled up to the new Orbitel SupraTropicana, owned jointly by the three gateway aerospacelines (Equatoriana, Aerospace Kenya, and Singapore Aerospacelines), Terre-Lune (say tehr' loon') Excursions Ltd\t, and Motel 6 ("the only luxury you want to pay for is the view”). At 1000 km or 600 miles up, the SupraTropicana is the highest orbiting of all the man rated orbital facilities yet built. This avoids the need for periodic reboosting caused by the drag of the tenuous upper atmosphere, but the real rationale behind the orbit choice is that following a zero inclination equatorial orbit, the guests of the orbitel would otherwise see only a narrow swath of the Earth below, repeated over and over - a slice through South America, Africa, Indonesia, and lots and lots of water. But at this higher altitude, at least the entire tropics lie within the orbitel's horizons.

A few hours in the SupraTropicana calms us down from the excitement of the boost up from Quito, and allows us to get our space sickness medication adjusted We all enjoy the Olympian view.

The 36 tourist class passengers and the 12 crew class (we get a fare break for one time service as ship personnel, after a bit of training, of course) are welcomed aboard Terre-Lune Excursions' flagship, the A.F.Jules Verne, by its permanent staff of two, the captain and first officer .This arrangement (a crew class in which paying passengers assist) drastically cuts overhead and allows TLE Ltd to offer more for the money At these prices, that's a must!

The Jules Verne is quite a ship. The A.F. stands for aerobrake ferry. A ferry is any space craft capable of plying a regular route without, however, ever landing anywhere It is meant for space alone. Being equipped with an aerobrake

means it can return from deep space and use the friction of a low angle graze of Earth's upper atmosphere to shed enough velocity to skip back out neatly into the desired orbit. As the aerobrake apparatus weighs a lot less than the extra fuel, the ship would otherwise have to carry for deceleration, an A.F. has more capacity for cargo and passengers: that after all is what pays the bills.

She is a beauty - once you come to appreciate the elegant efficiency of her design! For she is ungainly next to the transatmospheric Columbiad and doesn't at all remind one of the great spaceliners conjured up by science fiction writers.

At the 'bottom' is the gentle curve of the wide aerobrake shield which has shutters that open to expose the exhaust bells of the rocket engines. Above the aerobrake, are the engines, fuel tanks, and the umbilical tether cable reel and winch. On a platform above all this sit two of the three cylindrical habitation units or 'habules' (the initiated simply call them 'cans') built by Occupod and brought up on the Hercules Heavy Lifter One of the habules is a sleeper lounge whose name plaque reads Moonlight Sonata .The other is the diner lounge with the pretentious French name (no reference to the cuisine!) La Vache Sautante (say la vahsh' soh tahnt')("the jumping cow").

Above and nestled between these is the third habule, an observation lounge named Claire de Lune ("moonlight") with roll top shutters over vista windows along its topside, used during the lunar overflight, and petal shutters over the end cap windows which offer views of the receding Earth and approaching Moon on the way out, vice versa an the way back (Why the ship cruises sideways you'll see shortly). Concourse between the three habules is via a triangle of pressurized passageways at either end, the modest bridge being attached to one of these. So this gives you some idea of what the JV looks like during power mode, during the lunar overflight in which it is upside down to afford the fullest view, during aerobrake maneuver, or buttoned up for flare protection, aerobrake towards the Sun. But this only covers a few short periods.

For most of the three day cruise out to the Moon, ditto on the way back, the ferry is in cruise mode. The habule bridge complex is then released from its platform, while remaining attached to it by a tethered harness attached to the ends of the observation lounge (the top one on the stack). The complex is then rotated so the bottom two habules are furthest from the aerobrake engine tank complex, and the tether is reeled out a couple hundred meters, while the thrusters on the engine complex start the counter weighted system slowly rotating at a rate that provides 1/6th

gravity enough to make the passengers and crew comfortable and at the same time give them all a chance to experience what being 'on' the Moon itself would be like, vicariously. On the return, however, with the lunar experience behind them, the tether split ferry spins the first half of the return at a rate twice as fast to give all a foretaste of Mars, and finally spins up to full Earth normal gravity to ease their adjustment going home.

Hot racking is the rule on board, no exceptions. Each berth must be shared by two passengers in rotation. Morning people like me, those who find getting up easy if not altogether a joy, sleep first from 1600-2330 hours ship time. We can retire as early as 1430 but must vacate the berth promptly so the crew class passengers can get them ready for the next shift, the night people, those who find getting up distasteful. They have the berths from 2400-0730 but may tarry till 0900. (A surplus of either 'morning' or 'night' people is handled first by volunteers and then if necessary, by a draw.) From 0800-1530 everyone is in either the diner or the observation lounge. Ship time is set so that the periods when everyone is up coincide with departure from LEO, the lunar overflight itself, and the final return approach to Earth. Time sharing the facilities allows the ship to carry twice the number of passengers it could otherwise handle, or to put it another way, charge only half the exorbitant fare it would otherwise need to show a profit.

Terre-Lune Excursions Ltd goes all out to provide a real 'lunar experience' and I do mean all out. Providing 1/6th G on the way out is only part of it. No opportunity to enhance the atmosphere is overlooked. The three habules are all furnished with materials that the early lunar settlements should be able to fabricate from the soil. This even goes as far as the color scheme: only those coloring agents, metal oxides and ions, that the early settlers will be able to extract economically are used. Furnishings are thus mostly of glass/glass composites (Glax™), sintered iron, ceramics, softened by crudely processed cotton, and fiberglass fabrics. Except for ceramic glazes, stained glass and green plants provide most of the color .This decor is called 'Lunar Dawn' in Terre-Lune's promotional brochure. One of the crew class passengers is a recruit who cheerfully explains all the options open to the settlers in adapting to their new home; naturally, I spend a lot of time plying her with questions. Add the 1/6th gravity, and those on board are getting a very genuine preview of life in the early settlements. And you thought all we were paying for was an up close view of a monotonous expanse of cosmic splash prints! But more about

that later.

I should say something about the food in La Vache Sautante diner. Even here an opportunity to set the stage is seized.

When tourists sign up for a cruise, they are all given a list of available food items and asked to check their preferences and preferred combinations and to select from a list of menu items accordingly.

Only those food items that an early settlement might expect to raise in its own farms are included on the list. So the variety available excludes all the more exotic choices to be readily had on Earth.

Chicken, rabbit, or cavy for meat and that only as an accent, talapia for fish, a half dozen vegetables and fruits, some herbs and a little in the way of spices.

Beverages include only water, vegetable and fruit juices and a few simple fruit based seltzers and herbal teas. But this limited selection gives a healthy and balanced nutrition and variety enough. Now the ship cannot stock to meet every combination of whims. So each passenger, for each meal gets to order (and check off the list) only from the food he/she has preordered before boarding. Towards the end of the cruise one’s selection becomes limited to what is left .The wiser passengers reserve some treats for last.

Even the games and reading materials aboard are in a form reproducible by an early colony. Now to be sure, some of this 'lunar experience' could be reproduced on Earth, but out here with no distraction or escape, plus the low gravity, the total effect is intense.

Finally, after three full days previewing the lunar frontier, we are approaching the old girl herself. Our anticipation is high This is, after all, the climax we paid for. Slowly, the thrusters despin the tether split ship and the spring loaded tether reels in our habule bridge section. Once back together and secure and gravityless, the ferry turns so that its top, the still shuttered vista windows in the ceiling of the observation lounge are kept Moonwards.

As it happens on this particular cruise, the Moon is between the Earth and the Sun, or 'new' and the nearside is dark.

Once we are almost opposite the limb and the Sun is off to the side, the shutters open just in time as we approach the sunset terminator now over Mare Orientalis, the great bullseye basin on the western limb.

We are still about 800 miles above the surface at this point, but the long evening shadows add dramatic relief to the wider field of view below Farside is fully illuminated for overflight. What a treat! But I am getting ahead of myself.

Before the shutters are

opened, those of us who want a filtered experience are fitted with special heads-up display helmets, a spinoff of military technology thanks to espionage which had made continued classification of the technology a joke. These smart helmets scan both the field of view and the direction of the eye's focus and then neatly yet unobtrusively appear to overprint on the lunar landscape the names of whatever features catch your attention for more than two seconds. The heads-up display also gives the estimated ages of the more prominent bright ray craters we see, as these fascinating features are far younger than the rest of the 3 1/2 to 4 billion year old surface. With the helmets to provide information, silence is requested and expected during the over flight. Yes, pointing is allowed! A few refuse the helmets. They want to be fully absorbed in the raw experience of the awesome magnificent desolation of the lunar terrain below (or is it above?).

Terre-Lune encourages direct observation, that is to say they discourage preoccupation with photography. The ferry's own cameras are making a very complete record of the whole overflight and can be programmed to pay particular attention to pre-specified features. Videos and slides and prints of this coverage can be purchased from the company for a low fee. Cameras are allowed but we are urged to use them to record on board life, and to keep them shuttered during the overflight itself.

We pass over the Mare Ingenii-Thomson crater area where robot rovers are even now surveying the site for the proposed Farside Advanced Radio Astronomy Facility (FARAF). Someday this ferry and others like it may be delivering electronic mail to FARAF, as a relay satellite at the L2 Lagrange point behind the Moon is frowned on. As planned, this is the very lowest point or periselene of our overflight and we are skimming just 50 miles above the surface. Even though there are no other clues to the scale of what we see, you can tell we are closer by the accelerated rate at which the scene is whizzing by.

Then we pass over the what is easily the most striking feature of Farside, the crater Tsiolkovsky with its very dark marefilled floor and bright massive central peak. Twenty years ago, crater central peaks were unnamed. Now they are given the first name of the person for whom the crater is named, where applicable. So in this case, we are looking at Mt Konstantin.

We have just been informed that the Jules Verne is about to launch a resupply pod destined for one of the nearside bases.

This one contains medical supplies, some requested seeds for the farms, specialized tools, and other low weight high value items. Such cargo

drops help defray the cost of our passage and perform an invaluable service for the pioneers below.

All good things come to an end, they say, and so we approach the eastern limb at Mate Smythii and the sunrise terminator, and there above the rugged morning shadowed horizon, Voilà, the Full Earth which so rivets our attention we forget to take a last glimpse at the moonscape below before we slip past the terminator into darkness.

Reminded, we now scan the inky blackness below each intent on being the first to catch site of the beacon at Base Two in western Mate Crisium before the vista window shutters close and we revert to the tether-split cruise mode for the 'downhill' coast home.

The next few hours finds a few talking excitedly, sharing their private experiences.

But most of us are unusually quiet.

There is a definite feeling of anticlimax, perhaps a hint of mild depression. But I think the bigger part of our complex mood is simple silence, in an attempt to absorb, assimilate, and relish the flood of visual input.

Not all cruises aboard the Jules Verne are like this one. Some are timed with either the waxing or waning Half Moon. (and Half Earth!) None are timed for Full Moon as that would mean that all of the farside would be invisible in the darkness and everyone wants to see some of that portion forever hidden to Earth-bound eyes.

But then there are talks on Moon/Mars differences to go with the Mars like gravity now provided for ambiance, and we begin to come out of our withdrawal. A shipboard wedding between two of the passengers certainly helps! To the familiar lilting strains of Christopher Cross's classic 'Arthur's Theme' (and its great refrain "When you get caught between the Moon and New York City, the best that you can do is fall in love"), it is an unforgettable moment.

The closing portion of the cruise features talks and discussions about the disturbing state of the environment on the almost deceivingly beautiful globe slowly growing ahead beyond the petal windows at one end of the Claire de Lune.

The captain draws our attention to subtle indications we otherwise would have missed of growing desertification, recently clear cut tropical forest lands, and heavily polluted oceanic currents I begin to see the deeper significance in the name of the cruise line. This has been not merely a trip 'from' the Earth to the Moon, but a rendezvous with both.

As in the cruise mode on the way out, our axis of rotation points parallel to our path. At last, still four hours out, we come out of cruise mode spin and secure for the aerobrake

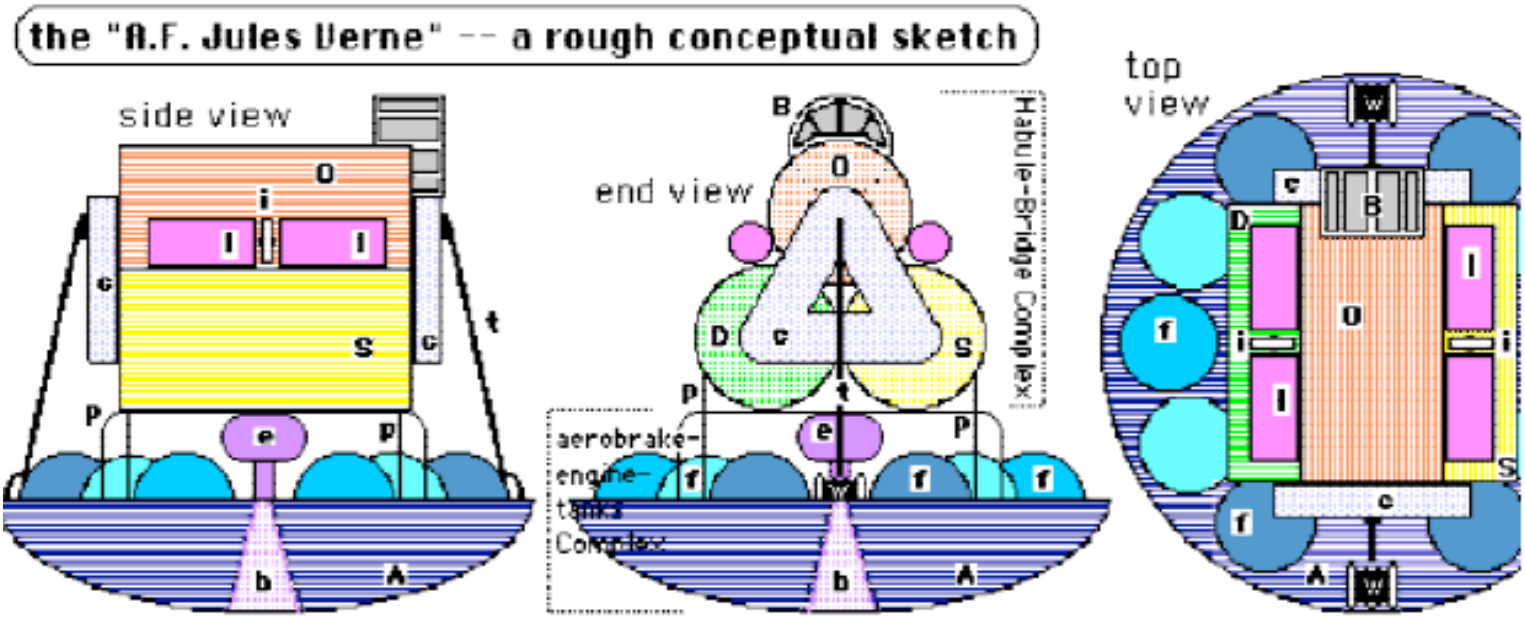
maneuver, half of us in the berth restraints, the others strapped in reclining lounge chairs. It is a nervous and tense moment for most of us.

It may be routine for the Jules Verne but every last one of us signed on green.

Suddenly the g-forces we feel ease and we freefall back out to the Orbitel.

The Boeing 808B is still docked, awaiting out return, with no other assignment during the past week Her crew and the staff of the SupraTropicana quiz us with an ill-suppressed hint of envy. Yes, it's been the experience of a lifetime, and with this sneak preview under my belt, I've lost the last of my hesitation. I am definitely going to apply to the Settler Recruitment Office the first chance I get.

I'm going to go back



KEY: **A** Aerobrake -- **B** Bridge -- **b** engine bell -- **c** inter-habule concourse -- **D** Diner-Lounge Habule -- **e** rocket engine -- **f** fuel tanks -- **i** anti-twist inertial orientation flywheels used in cruise mode -- **l** life support equipment -- **O** Observation-Lounge Habule -- **p** platform to nestle the Habule complex -- **S** Sleeper-Lounge Habule -- **t** tethers -- **w** winch reels for tether-deployment in cruise mode.

Simon Cook lives in a small town in northeast Wisconsin. His hobbies including hiking into waterfalls with his dogs, fixing up his place, and contemplating the starry night skies.

Submissions Guidelines

moonbeams@moonsociety.org

Moonbeams genre is primarily Speculative Science Fiction but we will accept nonfiction that is related to space colonization and/or lunar exploration. You do not have to be a Moon Society member to submit.

Moonbeams is about two things:

- the authors and getting their best work published
- making the case for space colonization

Successful fiction submissions must stick to accepted physics: no faster than light warp drives, no worm holes, no time travel, no transporters a la Star Trek and no alien monsters. No magic, no fantasy. Last but not least, no social, political, or religious diatribes. Send us a plausible story about the colonization of space and the moon and we will publish it. But don't stop there. The subtitle "Tales from the High Frontier" indicates that stories can be set anywhere in the Solar System. Nonfiction submissions on science and technology must be thoroughly referenced.

Everyone is welcome to submit pieces up to 5,000 words. We have a micro-story category, *Letters Home*, with a limit of 250 words. We also welcome comments and/or reviews of prior Moonbeams stories. These should be limited to 250 words.

We currently do not accept advertising in Moonbeams and thus, we produce no revenue stream. Therefore, authors cannot be compensated and will retain full rights for republication elsewhere.

Submissions should be in electronic form. MS Word is preferred but we will accept text files or other common word processor formats. All submissions that need to be keyed in will not be considered unless prior arrangements have been made. The preferred method of submissions is via email with the subject set to Moonbeams Submission. We will accept mailed cd/dvd at the following address:

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Chandler, Arizona 85225

Exchanging links is ok if your link is clearly space related. Moonbeams reserve the right to say no to any submission.

These guidelines are subject to review and will be adjusted as we go along. Moonbeams is YOUR magazine. Let's have some fun with it, shall we?

The Editor